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Scientific and Technical Aerospace Reports

Abstracts January–June 1963

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Scientific and Technical Aerospace Reports

A Semi-monthly Abstract Journal with Indexes

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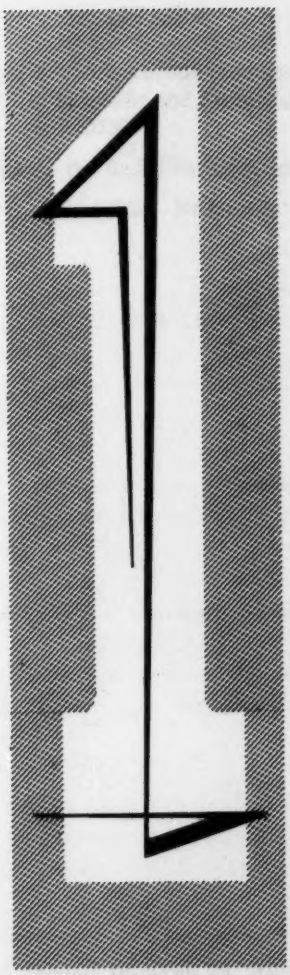

This is issue Number One of an improved abstract journal to serve the Aerospace Community

★ ***Published by the National Aeronautics and Space Administration, it will appear semimonthly.***

★ ***This new journal will continue the scope, coverage, and format of its predecessor,*** **TECHNICAL PUBLICATIONS ANNOUNCEMENTS,** ***Volume 2.***

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The inclusive range of NASA Accession Numbers on the front cover and spine of Volume 1, Issue Number 1 of Scientific and Technical Aerospace Reports was erroneously given as N63-10001—N63-10557.

You may wish to change the final two digits to agree with the correct range:

N63-10001—N63-10575

Issued January 25, 1963

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(2) scientific and technical reports of government agencies, universities, and industrial and independent research organizations in the United States and abroad; and

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Each abstract is prefixed by the NASA accession number, and the separate indexes contain explanatory notes which guide the user to the desired abstract.

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Scientific and Technical Aerospace Reports

A Semimonthly Publication
of the National Aeronautics and Space Administration

January 8, 1963

01 GENERAL

Includes: management; space law and legal matters; symposia or conferences of a broad or a general nature.

N63-10094 Republic Aviation Corp., Farmingdale, N. Y.
A STUDY OF THE AIR FORCE MAINTENANCE TECHNICAL DATA SYSTEM [Final Report]
J. W. Losee, R. H. Allen, J. W. Stroud, and J. Ver Hulst
Wright-Patterson AFB, Ohio, Behavioral Sciences Lab., Aug. 1962
199 p 5 refs
(Contract AF 33(616)-8193)
(AMRL-TDR-62-85) OTS: $5.00

This report details the research on preparation, production, distribution, evaluation, and verification of Air Force maintenance technical data. It highlights the impact of management on the procurement of accurate, timely, and economical data and identifies the areas in which management was found to be deficient. It points out the specific shortcomings in the data, in its preparation, distribution, and use. Finally, the report recommends actions considered necessary to first, improve the overall technical order system of management, and second, to enhance the quality, usefulness, and timeliness of the data produced. Author

N63-10165 Massachusetts Inst. of Tech. Research Lab. of Electronics, Cambridge
QUARTERLY PROGRESS REPORT NO. 6 [FOR THE THREE-MONTH PERIOD ENDING AUG. 31, 1962]
H. J. Zimmermann, G. G. Harvey, and W. B. Davenport, Jr.
Oct. 15, 1962 298 p 265 refs
(Contracts DA 36-039-sc-78108 and DA-SIG-36-039-61-G14)

This review covers work in progress on the following: soft X-ray spectroscopy; physical chemistry; microwave spectroscopy; nuclear magnetic resonance and hyperfine structure; microwave electronics; molecular beams; plasma physics; plasma electronics; plasma magnetohydrodynamics and energy conversion; statistical communication theory; processing and transmission of information; speech communication; mechanical translation; linguistics; communications biophysics; neurophysiology; neurology; cutaneous sensory mechanisms; sensory aids research; circuit theory and design; and computer research. B.J.C.

N63-10230 Virginia Polytechnic Inst., Blacksburg
REENTRY DYNAMICS, PART II. PROCEEDINGS OF THE CONFERENCE ON PHYSICS OF THE SOLAR SYSTEM AND REENTRY DYNAMICS, JULY 31 TO AUG. 11, 1961 Sponsored by NASA. Langley Research Center, and NSF
Dean R. Chapman, Leonard Roberts et al [1962] 363 p 238 refs
(Supported by NSF Grant)
In its Bulletin, Eng. Expt. Sta. Series No. 150, v. 55, no. 10 Aug. 1962
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N63-10370 Air Force Systems Command. Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif.

TRANSACTIONS OF THE SEVENTH SYMPOSIUM ON BALLISTIC MISSILE AND SPACE TECHNOLOGY, U.S. AIR FORCE ACADEMY, COLO., AUG. 13-16, 1962. VOL. I: SPACE VEHICLES AND SYSTEM DESIGN, HYPERSONICS AND RE-ENTRY TECHNIQUES, PROPULSION, STRUCTURES AND MATERIALS, MATHEMATICAL RELIABILITY TECHNIQUES Sponsored by USAF and Aerospace Corp., Los Angeles, Calif.

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N63-10389 Air Force Systems Command. Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif.

TRANSACTIONS OF THE SEVENTH SYMPOSIUM ON BALLISTIC MISSILE AND SPACE TECHNOLOGY, U. S. AIR FORCE ACADEMY, COLO., AUG. 13-16, 1962. VOL. II: EARTH SATELLITE CONTROL AND CONTROL SYSTEMS, CONTROL OF MANNED SPACE ENVIRONMENT, SIMULATION, COMMUNICATIONS Sponsored by USAF and Aerospace Corp., Los Angeles, Calif.

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N63-10419 Mound Lab., Miamisburg, Ohio
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N63-10420 Mound Lab., Miamisburg, Ohio
MOUND LABORATORY MONTHLY PROGRESS REPORT FOR FEBRUARY 1962
J. F. Eichelberger Feb. 28, 1962 31 p
(Contract AT-33-1-GEN-53)
(MLM-1133)

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N63-10421 Mound Lab., Miamisburg, Ohio
MOUND LABORATORY PROGRESS REPORT FOR MARCH 1962
J. F. Eichelberger Mar. 30, 1962 24 p
(Contract AT-33-1-GEN-53)
(MLM-1135)

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N63-10526 Joint Publications Research Service, Washington, D. C.
SOVIET-BLOC RESEARCH IN GEOPHYSICS. ASTRONOMY AND SPACE, NO. 48, 1962
Gennadiy Vorob'yev Nov. 30, 1962 31 p 46 refs Contains abstracts, summaries, and translations of articles from recent publications of the Sino-Soviet Bloc countries
(JPRS-16455) OTS: Annual subscription, $6.00

This semimonthly serial publication consists of materials gathered from recent publications of the Sino-Soviet Bloc Countries, presented in the form of abstracts. Author

02 AERODYNAMICS OF BODIES, COMBINATIONS, AND INTERNAL FLOW

Includes: aerodynamics of channels, cowls, ducts, ejectors, nozzles, etc.

For related information see: 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 11 Fluid Mechanics.

N63-10011 Entwicklungsring Süd, Munich (W. Germany)
WIDERSTANDSVERMINDERUNG DURCH RUMPFAUFTRIEB IM ÜBERSCHALL [RESISTANCE REDUCTION THROUGH FUSELAGE LIFT IN THE SUPERSONIC]
R. Wolf [1962] 11 p 5 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-12, 1962

(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 13) Available from Friedrick Vieweg & Son, Burgplatz 1, Bunswick, W. Germany

It is demonstrated theoretically that the lift-dependent resistance can be basically reduced when a distributed lifting force is brought against a fuselage. In actual practice, the attainment of optimum fuselage lift distribution cannot be expected. However, by varying the cross section of the fuselage it is possible to pring a lifting force to the fuselage so that the resistance of the configuration may be definitely reduced. A.S.

N63-10021 Technische Hochschule Stuttgart (W. Germany)
DAS MAXIMUMPRINZIP UND DIE OPTIMIERUNGEN DER FLUGMECHANIK [THE MAXIMUM PRINCIPLE AND THE OPTIMIZATION OF FLIGHT MECHANICS]
P[eter] Sagirow and M. Frik [1962] 16 p 8 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-12, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 23) Available from Friedrick Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

General optimization of flight mechanics problems are considered, with the help of Maximum Principles. In linear cases, the structure of the control function can be determined using these principles. The advantages of the Maximum Principles are: (1) It is possible to obtain continuous as well as discontinuous solutions to optimization problems. (2) In determining optimum control it is immaterial whether the problem is plane or spatial. A.S.

N63-10022 Deutsche Versuchsanstalt für Luft- und Raumfahrt. Inst. für Flugmechanik, Mülheim an der Ruhr (W. Germany)
THEORETISCHE UND EXPERIMENTELLE UNTERSUCHUNGEN AN SAALFLUGMODELLEN [THEORETICAL AND EXPERIMENTAL STUDIES OF ROOM FLIGHT MODELS]
Max Hacklinger [1962] 36 p In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-12, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 24) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

This paper considers the problems involved in the development of a room-flying model, specifically ruggedness, aerodynamics, driving power, flight mechanics, and aeroelasticity. Trans. by A.S.

N63-10023 Deutsche Forschungstalt für Luft- und Raumfahrt. Inst. für Flugmechanik, Brunswick (W. Germany)
THEORETISCHE UNTERSUCHUNGEN ZUR DYNAMISCHEN STABILITÄT VON FALLSCHIRMEN [THEORETICAL STUDIES OF THE DYNAMIC STABILITY OF PARACHUTES]
R. Ludwig and W. Heins 1962 13 p 6 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-11, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 25) Available from WGL, Friedrich Vieweg & Son, Burgplatz 1, Burnswick, W. Germany

The oscillation of the parachute under consideration could not be treated because of linearization of the motion equations. By means of nonlinear study it is just possible to represent the oscillation frequency. Aside from this, it is shown that the frequency and damping amplitudes are dependent upon each other. For equal amplitude values, the square of the oscillation is proportional to the distance cap-load. With increasing porosity of the parachute cap, the damping is increased and oscillation duration is decreased. A.S.

N63-10068 Avco-Everett Research Lab., Everett, Mass.
THE UNSTEADY HYPERSONIC WAKE BEHIND SPHERES
J. A. Fay and A. Goldburg Nov. 1962 43 p 21 refs
(Contracts AF 04(694)-33 and DA-19-020-ORD-5476)
(Avco-Everett Res. Rept.-139; BSD-TDR-62-105)

Optical observation of self-luminous wakes behind spheres suggest that vortex loops are generated behind a blunt hypervelocity body and are shed at regular intervals in a manner similar to that which is observed in incompressible flow. Transition phenomena for the hypersonic wake are examined in the light of this vortex shedding hypothesis. A quantitative correlation of transition Reynolds number and Strouhal number is presented for luminous wakes behind spheres in air, argon and xenon at Mach 15 to 25. The values of the Strouhal numbers were obtained by the drum camera technique. The variation of the hypervelocity Strouhal number with Reynolds number shows classical behavior and has an asymptotic limit of about 0.35. Author

N63-10133 Massachusetts Inst. of Tech. Aeroelastic and Structures Research Lab., Cambridge
FURTHER STUDIES ON HIGH-SPEED UNSTEADY FLOW [Final] Technical Documentary Report [May 1961-Mar. 1962]
Garabed Zartarian and Harry Sauerwein Wright-Patterson AFB, Ohio, Flight Dynamics Lab. Sept. 1962 103 p 29 refs
(Contract AF 33(616)-7883)
(ASD-TDR-62-463)

Three specific problems of high-speed unsteady flow are investigated. The first involves an extension of the shock-expansion method and its application to wing and body oscillations at large amplitude. Secondly, the unsteady Newtonian theory of Hayes and Probstein, with centrifugal and Coriolis effects included, is examined in the light of the nontrivial questions of computational organization and engineering usefulness. Thirdly, the subject of time-dependent airloads as influenced by rapid changes in the ambient environment is explored. Although the motion of two-dimensional airfoils is emphasized, the difficulties which arise when one attempts to analyze three-dimensional cases are discussed. Author

N63-10139 Aeronautical Research Council (Gt. Brit.)
A CONSIDERATION OF THE SIMILARITY REQUIREMENTS FOR AEROTHERMOELASTIC TESTS ON REDUCED SCALE MODELS
W. G. Molyneux London, HMSO, Feb. 1962 38 p 17 refs Presented at the USAF ASD Symposium on Aerothermoelasticity, Dayton, Ohio, Oct. 30, 1961
(ARC-CP-611; previously issued as RAE-TN-STRUCT-309; ARC-23785)
Available from HMSO: 5s. 6d.

The similarity requirements for model tests are established and different possibilities with regard to relaxations of these requirements are examined with the aim of devising an acceptable experimental technique for representative tests on models of reduced scale. It appears that the representation of heating effects most of necessity be rather crude, but may nevertheless be adequate for aerothermoelastic research. Test techniques that provide a reasonably close representation of flight conditions require tunnels with heated flow and with subsidiary radiant heat in the working section. Failing this, models can be constructed with an effective stiffness representative of heated conditions for tests in conventional facilities. Author

N63-10153 Weapons Research Establishment (Australia)
WIND TUNNEL FORCE AND MOMENT TESTS (EXCLUDING DRAG) AT MACH NUMBER 2.58 ON THREE-FIN AND FOUR-FIN MODELS OF THE SKYLARK HIGH ALTITUDE RESEARCH VEHICLE
D. F. Morrison and J. A. Rein Feb. 1962 42 p 1 ref
(Tech. Note HSA-86)

Results are given of measurements of normal force, pitching moment, side force, yawing moment, and rolling moment on three-fin and four-fin models of Skylark with the same individual fin panel areas. The tests were made at incidences up to 20°, and the ranges of roll angles required by symmetry, at a Mach number of 2.58 and at a Reynolds number of 4.0×10^6 based on overall length. The four-fin configuration showed a significant reduction in side force and rolling moment over the three-fin arrangement. Author

N63-10178 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

STATIC STABILITY INVESTIGATION OF PROPOSED PROJECT FIRE SPACE-VEHICLE AND REENTRY-PACKAGE CONFIGURATIONS AT MACH NUMBERS FROM 1.47 TO 4.63

Dennis E. Fuller and C. Donald Babb Washington, NASA, Nov. 1962 22 p 1 ref
(NASA TN D-1497) OTS: $0.75

Tests were conducted in the Langley Unitary Plan wind tunnel on proposed space-vehicle and reentry-package model configurations for Project Fire. Five different second-stage velocity-reentry-package combinations were investigated as part of the two-stage space-vehicle configuration. Only one reentry-package configuration was tested. Tests were performed through an angle-of-attack range from about −7° to 18°. The Reynolds number for these tests was held constant at 3.0×10^6 per foot. Author

N63-10492 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SHOCK-WAVE PROFILES OVER ELLIPSOIDAL-NOSED BODIES IN SUPERSONIC FLOW

Carlton S. James and James E. Terry May 14, 1962 Repr. from J. Aerospace Sci., v. 29, no. 9, Sept. 1962 Previously published as a preprint; for abstract see N62-12800 08-02

A semiempirical analytical method is given for the accurate synthesis of the bow shock profiles generated by the ellipsoid family of noses whose shapes are defined as $r^2 = (d/2)^2/1^2\ (A^2 - x^2)$. The applicability of the method is not limited to the ellipsoid family. Studies of additional data have indicated that the method, with only slight modification, is applicable to cylinders with conical and spherically blunted conical noses for values of x/d greater than about 2. It is thought likely that the same method could be applied to gases other than air. J.R.C.

03 AERODYNAMICS OF WINGS, ROTORS, AND CONTROL SURFACES

Includes: ailerons; airfoil sections; cascades; fans; flaps; propellers; rotors; slats; spoilers; etc.

For related information see: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; and 11 Fluid Mechanics.

N63-10004 Royal Aircraft Establishment, Farnborough (Gt. Brit.)

DIE AERODYNAMISCHE ENTWICKLUNG VON SCHLANKEN FLÜGELN FÜR DEN ÜBERSCHALLFLUG [THE AERODYNAMIC DEVELOPMENT OF THIN WINGS FOR SUPERSONIC FLIGHT]

K. Küchemann [1962] 42 p 35 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-11, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 5) Available from WGL, Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

This report contains a short review of the aerodynamic properties of thin wings as well as an account of the research work that is being carried out with the purpose of developing a supersonic transport airplane. On the aerodynamic side, an effort is being made to find a thin wing of an approximately basic delta form. It is hoped that a single wing of this type will be found that will maintain the same type of flow in the entire flight domain. This flow type includes vortex bands that depart from all wing edges and develop in a regular manner. The disturbances of the air flow are small, especially in the transonic and supersonic regions. A.S.

N63-10009 Institut für Luftfahrttechnik, Technische Hochschule, Darmstadt (W. Germany)

EIN DOPPELTRAGLINIENVERFAHREN ZUR UNTERSUCHUNG DES FLÜGELS IN BODENNÄHE [A DOUBLE CARRIER CURVE METHOD FOR THE STUDY OF WINGS NEAR THE GROUND]

U. Ackermann 1962 18 p 6 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-11, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 11) Available from WGL, Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

This paper concerns the use of a double carrier curve method for studying wing characteristics in free flight. The findings apply only to small angles of attack. M.B.S.

N63-10010 Aerodynamische Versuchsanstalt, Göttingen (W. Germany)

DREI-KOMPONENTENMESSUNGEN AN SYMMETRISCHEN TRAGFLÜGELN VERSCHIEDENER UMRISSFORMEN IN ÜBERSCHALLSTRÖMUNG [THREE DIMENSIONAL MEASUREMENTS OF SYMMETRICAL WINGS OF VARIOUS OUTLINES IN SUPERSONIC FLOW]

W. Stahl and P. -A. Mackrodt [1962] 41 p 10 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-11, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 12) Available from WGL, Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

In the high velocity wind tunnel of the AVA, three dimensional measurements were made of five untwisted wings of various shapes (rectangular, triangular, arrow-shaped, trapezoidal, and parabolic). Measurements were taken at five Mach numbers (1.23, 1.49, 1.73, 1.98, 2.25). All of the wings had equivalent outline surface areas and equivalent symmetrical profiles (NACA 65 A 005). The lift increase $\frac{dc_A}{d\alpha} c_A = 0$, relative neutral point displacement $\frac{\Delta x_N}{l} c_A = 0$, lift dependent resistance $\frac{\Delta c_W}{2}$, and resistance at zero lift c_{W_o}, were carried out at or above these Mach numbers, and showed, with the exception of the zero lift resistance, a satisfactory agreement with the linearized theory of thin wings. A.S.

N63-10012 Deutsche Forschungsanstalt für Luft- und Raumfahrt Inst. für Aerodynamik, Brunswick (W. Germany)

EXPERIMENTELLE UND THEORETISCHE UNTERSUCHUNGEN AN AUSBLASEFLÜGELN UND IHRE ANWENDUNG BEIM FLUGZEUGENTWURF [EXPERIMENTAL AND THEORETICAL INVESTIGATIONS OF EXHAUST-TYPE WINGS AND THEIR APPLICATION IN AIRPLANE DESIGN]

G. Streit and F. Thomas [1962] 29 p 17 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-12, 1962 Research done jointly with Weser Flugzeubau G.m.b.H., Breman
(DFL-62/35; Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 3) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

With the aid of wind tunnel measurements, the influence of stroke depth and striking edge radius upon the aerodynamic coefficient is studied. These measurements also permitted studying how to avoid use of the separation impulse coefficient. Both studies were done on an exhaust-type wing of the NACA 63₁-A218 type. A sample computation of the effect of the boundary influence during takeoff and landing of airplanes was demonstrated. Trans. by A.S.

N63-10017 Training Center for Experimental Aerodynamics, Rhode-Saint-Genèse (Belgium)

THE CONCEPT OF BLUNT TRAILING-EDGE BLADING FOR USE IN SUPERSONIC COMPRESSORS

J. Chauvin [1962] 57 p 19 refs Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-11, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 19) Available from WGL, Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

A review of the work done in the U.S.A. on supersonic compressors is done. A survey of the research made by the NACA points out the reason for failure of the design tested, namely, shock-boundary layer interaction effects and secondary flow effects. The work done under sponsoring of the Aeronautical Research Laboratory on shock-boundary layer interaction and passage optimization is summarized and shown to lead to a new blading concept. This concept is based on the diffusion of the flow in the blading by a pseudoshock system, created in a channel of essentially constant area, obtained by use of circular arc blades of unconventionally high solidity. Some flow models for performance prediction are proposed. A rapid analysis of the limited amount of experimental data available shows that quite reasonable performance can be obtained for rotors using blunt trailing-edge bladings, if losses in the higher speed range, believed to be due to secondary flow effects, can be eliminated. Author

N63-10018 Bölkow-Entwicklungen, Munich (W. Germany)
UNTERSUCHUNG VON STRAHLRUDERN [RESEARCH ON JET RUDDERS]
A. Hammer and R. Jahn [1962] 32 p 7 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-11, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 20) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

Experimental and theoretical studies employing rudders set in a supersonic jetstream at a Mach number of 3.0, and with supplementary, simulated, external flows, were set up. Near the nozzle and at counterpressure to the nozzle stream flow, the distance of the rudder from the nozzle outlet and the geometry and setting of the rudder were varied. This permitted the parameters of the rudder effectiveness to be studied. Trans. by A.S.

N63-10024 Deutsche Forschungsanstalt für Luft- und Raumfahrt. Inst. für Luftfahrzeugführung, Brunswick (W. Germany)
ERFAHRUNGEN BEI KINOTHEODOLITMESSUNGEN AN FALISCHIRMEN [KNOWLEDGE GAINED FROM MOVIE-THEODOLITE MEASUREMENT OF PARACHUTES]
O. Weber 1962 23 p 3 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-11, 1962
(Wissenschaftlichen Gesellschaft fur Luftfahrt Paper No. 26) Available from WGL, Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

To overcome the high incidence of total loss of parachute and parachute load, a method has been devised for the determination of the chance and systematic error of parachute drops by using as coordinates the path, the velocity vector, and acceleration vector of the various components of a parachute and parachute load system. The equipment consists of two movie-theodolites. If more than two are employed in simultaneity, more measurement values are obtained and a greater volume of data processed, but the results are not always of proportionate accuracy. M.B.S.

N63-10046 Focke-Wulf, Bremen (W. Germany)
STRAHLABLENKUNG AN ZWEIKREISTRIEBWERKEN DURCH SPOILER [JET DEFLECTION IN TWO-CIRCUIT ENGINES BY MEANS OF SPOILERS]
W. Seibold and W. Bongartz Aug. 20, 1962 38 p In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-11, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 51) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

Jetstream deflection is a problem confronting aircraft construction today. Particularly in the case of VTOL aircraft the deflection of jetstream radiation can be used for stabilization purposes in hovering flight. The effectiveness of jet deflection processes is demonstrated in this paper and the theoretical studies limited to even flow. M.B.S.

N63-10057 Junkers Flugzeug- und Motorenwerke A. G., Munich (W. Germany)
DIE LEITRADVERSTELLUNG IN AXIALVERDICHTERN [IMPELLER ADJUSTMENT IN AXIAL COMPRESSORS]
Henry Happe [1962] 26 p 2 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-12, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 62) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

The operation of multiple-stage compressors requires that all stages operate simultaneously. Only in operation during the layout period are the individual gratings in exact position with reference to each other. Through changes in the number of revolutions or changes in the counterpressure, all phases are affected. Upon compression with a greater number of stages, proximity to the separation or absorption boundary is reached. There is also the possibility that individual phases operate with separate flows. This paper investigates setting possibilities for a multistage compressor. A.S.

N63-10062
BEOBACHTUNGEN ÜBER DAS VERHALTEN DER DURCH WASSERDAMPFDONDENSATION AUSGELÖSTEN STÖRUNGEN IN EINER ÜBERSCHALL-WINDHANALDÜSE [OBSERVATIONS OF THE BEHAVIOR OF THE TURBULENCES CAUSED BY WATER VAPOR CONDENSATION IN A SUPERSONIC WIND TUNNEL NOZZLE]
Bernd Schmidt [1962] 8 p 10 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-12, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 68) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

A study of the effect of turbulence caused by water vapor condensation in a supersonic wind tunnel nozzle is described. The flow about a body with a high velocity profile is investigated. A periodic reciprocity is found between a local supersonic domain of horizontal condensation and a supersonic domain of separate impacts. The result of this reciprocity is a profile of pressure fluctuation, the significance of which has not yet been determined. M.B.S.

N63-10067 National Aero- and Astronautical Research Inst., Amsterdam (Netherlands)
WINDTUNNEL INVESTIGATION WITH A TWO-DIMENSIONAL AIRFOIL ON THE EFFECT OF BLOWING OVER A FLAP AND OVER A CONTROL SURFACE Provisional Issue
B. van den Berg Sept. 28, 1962 28 p 13 refs Presented at the [Scientific Soc. for Aviation] Annual Meeting, Brunswick, W. Germany [Oct. 9-11, 1962]
(Supported by Ministry of Defense and Netherlands Aircraft Develop. Bd.)
(MP-215; Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 75) Available from WGL, Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany)

The first part of the investigation deals with blowing over a flap deflected to angles up to 75°. The width of the blowing slot, located in the wing just ahead of the flap, could be varied. Lift, drag and pitching moment have been measured. The results have been

compared with those of other similar experiments. In the second part, the effect of blowing over a control surface with an exposed overhang balance has been investigated. Author

N63-10199 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LONGITUDINAL AERODYNAMIC CHARACTERISTICS AT LOW SUBSONIC SPEEDS OF A HIGHLY SWEPT DELTA WING UTILIZING NOSE DEFLECTION FOR CONTROL
Bernard Spencer, Jr. Washington, NASA, Nov. 1962 28 p 8 refs
(NASA TN D-1482) OTS: $0.75

An investigation has been conducted on a delta wing-of-aspect ratio 1.33 to determine the longitudinal control characteristics associated with deflecting the apex section of the wing. In order to illustrate the effectiveness of this forward control, the longitudinal control characteristics are also presented for the wing with split flaps located at the trailing edge. Author

N63-10314 Stanford U., Calif.
AN EXPERIMENTAL STUDY OF JET-FLAP THRUST RECOVERY Final Report
William M. Foley (Ph. D. Thesis) July 1962 127 p 24 refs
(Sponsored by General Dynamics/Convair)
(SUDAER-136)

The experiments described were undertaken in an effort to verify or disprove Davidson's widely disputed statement of Stratford's theorem which predicts complete thrust recovery by idealized jet-flapped airfoils in inviscid, two-dimensional flow. Two vertical-longitudinal partitions were installed in the normally open throat of the Stanford University 7.5-foot-diameter wind tunnel to enable the two-dimensional testing of a jet-flapped wing model of symmetric profile, 1-foot chord, and 2-foot span. Special attention was given to the provision of strictly two-dimensional flow, to the prevention of air leakage between model tips and test-section walls, to the elimination of extraneous forces, and to the improvement of methods previously used for the evaluation of thrust recovery. Analysis of the force-test results revealed that approximately 94 percent of the ideal jet reaction was recovered in the form of upstream thrust with all jet deflection angles up to the maximum test angle of approximately 59 degrees. Since the reaction forces measured during jet discharge into still air did not exceed 94 percent of the ideal reactions, all actually available thrust appears to have been recovered. Stratford's theorem for the idealized two-dimensional case has, therefore, been verified—at least inferentially—by these experiments. By analysis of the force and pressure-distribution data, it was deduced that thrust recovery at constant lift, at least in the case of the configuration used for these experiments, resulted almost exclusively from the action of internal (plenum chamber) pressure forces. Author

N63-10351 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio
THE EFFICIENCY OF A CROSS-RIBBED CURVILINEAR DIFFUSER
V. K. Migay Sept. 11, 1962 7 p 2 refs Transl. from Energomashinostroenie (Moscow) no. 1, 1962 p 45-46
(FTD-TT-62-1151/1+2+4)

An investigation is made of the increase in efficiency of a diffuser by installing especially designed cross-ribbing on its walls. It was determined that there is no necessity to cover the entire surface of the flow section with ribs; it is enough to install a definite and relatively limited number of them. The results show that cross-ribbings installed on the walls of curvilinear diffusers lead to an increase in their efficiency and that the efficiency of a ribbed diffuser significantly depends upon the arrangement of the ribs in the flow section. J.R.C.

N63-10456 Aeronautical Research Council (Gt. Brit.)
A COMPARISON OF RESULTS IN THE A.R.A. TRANSONIC TUNNEL ON A SMALL AND A LARGE MODEL OF A SLENDER WING
T. E. B. Bateman and A. B. Haines 1962 36 p 5 refs
(ARC-R&M-3287; previously issued as ARA Wind Tunnel Note 42, ARC-23237) Available from HMSO: 14s. 6d.

Force, moment, and pressure-plotting measurements are reported on 75 deg slender wings of 60 in. and 20 in. lengths in the Aircraft Research Association 9 ft X 8 ft perforated wall transonic tunnel. The object of the tests was to obtain some idea of the tunnel-interference corrections for slender-wing models. The results suggest that, in general, tests on slender-wing models placed at the most suitable position in the tunnel should give reasonably interference-free results at Mach numbers above about M = 1.1. On the basis of the evidence presented in this paper, it should be possible to devise corrections even in the range M = 1.0 to 1.1 particularly if a few pressure-plotting points are included in the models under test. Author

N63-10466 North American Aviation, Inc., Los Angeles, Calif.
TEST AND MODEL INFORMATION FOR WIND TUNNEL TESTS OF 9 X 18 INCH FLUTTER PANELS IN THE AMES 2 X 2 FOOT TRANSONIC AND 1 X 3 FOOT SUPERSONIC WIND TUNNELS
G. M. Stone Sept. 27, 1962 17 p 3 refs
(Contract AF 33(657)-8515)
(NA-62-1110)

This report presents the necessary information for testing nine flutter panels in the 2 ft x 2 ft transonic and 1 ft x 3 ft supersonic wind tunnels at NASA Ames Research Center. These tests will be conducted at Mach Numbers of 0.9, 1.05, 1.3, 1.5, 2.0 and 2.6 to determine the flutter characteristics of various configurations of thin aluminum panels. The effect of boundary-layer control on the flutter characteristics of the panels will also be investigated. J.R.C.

N63-10537 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HOVERING CHARACTERISTICS OF A ROTOR HAVING AN AIRFOIL SECTION DESIGNED FOR A UTILITY TYPE OF HELICOPTER
James P. Shivers and William J. Monahan Washington, NASA, Dec. 1962 22 p 11 refs
(NASA TN D-1517) OTS: $0.75

Static-thrust performance data are presented for a full-scale rotor having an NACA 63$_1$A012 airfoil thickness distribution in combination with an NACA 130 mean line for blade tip Mach numbers from 0.28 to 0.75. These results are compared with a previously investigated rotor having an NACA 63$_1$A015 airfoil thickness distribution in combination with an NACA 230 mean line. Author

04 AIRCRAFT

Includes: specific types of complete aircraft (e.g., Ground Effects Machines, Flexible Wings, STOL, and VTOL); flight tests; operating problems; stability and control.

For related information see: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 30 Space Vehicles.

N63-10005 Gt. Brit. Ministry of Aviation, London
SOME THOUGHTS ON THE TECHNICAL BACKGROUND TO SUPERSONIC TRANSPORTS

L. F. Nicholson [1962] 34 p 4 refs Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-11, 1962
(Wissenschaftlichen Gisellschaft für Luftfahrt Paper No. 6) Available from WGL, Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

A brief review is given of some of the technical thinking on supersonic transports which lies behind British enthusiasm for a light alloy design based on slender wing principles. The major driving force behind the use of supersonic transport is that it is potentially the cheapest means of long-range air transport. This is true because of the very high thermal efficiency of jet engines at supersonic speeds combined with slender wing designs of light structure weight with good cruising performance and acceptable low-speed performance. J.R.C.

N63-10006 Aeronautical Research Inst. of Sweden, Stockholm
SPEED AND SAFETY IN CIVIL AVIATION
Bo Lundberg [1962] 97 p Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-11, 1962 Also presented at the Third International Congress of the Aeronautical Sciences, Stockholm, Aug. 27-31, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 7) Available from WGL, Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

The role that speed and safety play in civil aviation is analyzed. Flight speed is only one of the two main factors governing short travelling times, the other being short ground times to and from the airport. A need is expressed for speed increase and also for mastering the V/STOL problem in its broadest sense. A study is made of the noise problem and its relation to communities, airports, and heliports. It is determined that the ranges in which supersonic speeds might give some advantage are limited to the bracket from about 2000 to 5000 miles. It is concluded that in such ranges the gain will be rather marginal on a pure time/comfort basis, even if the fares could be kept as low as for competing subsonic airliners. Thus, on the basis of the foreseeable level of the art, the prospects of profitable supersonic aviation are indeed questionable, even disregarding completely the host of new and difficult problems that will be encountered, in particular the paramount safety problems of sonic booms, cosmic radiation, and fatigue of heated structures. J.R.C.

N63-10007 Deutsche Lufthansa Aktiengesellschaft, Hamburg (W. Germany)
EINIGE WIRTSCHAFTLICHE PROBLEME DES EINSATZES VON ÜBERSCHALLVERKEHRSFLUGZEUGEN [SEVERAL SIGNIFICANT PROBLEMS IN THE INAUGURATION OF SUPERSONIC TRANSPORT AIRCRAFT]
Ernst Simon [1962] 19 p 37 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-11, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 8) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

Significant problems with which air transportation operators are faced when considering inauguration of supersonic air transportation are discussed. Practicability and economy are major considerations. Aspects covered are: purchase cost of supersonic aircraft, depreciation, insurance, crew costs, maintenance and overhaul, landing and takeoff tariffs, fuel costs, aircraft utilization per year, and permissible departures from optimal operational conditions. A.S.

N63-10025 Fock-Wulf, Bremen (W. Germany)
ÜBER DIE MÖGLICHKEIT DES ZIVILEN EINSATZES VON SENKRECHTSTARTFLUGZEUGEN [ON THE POSSIBILITY OF CIVILIAN INAUGURATION OF VERTICAL START AIRCRAFT]
Rolf Stüssel [1962] 51 p 16 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-11, 1962
Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 27) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

Conventional and vertical takeoff transport planes have been compared for the influence on the economy. The comparison leads to the finding that in the present state-of-the-art, the unfavorably appearing vertical takeoff plane, despite its higher operating cost, can augment air transportation because of independence of weather influences. In this manner, the higher cost of operation by comparison with conventional planes is offset. Aside from these facts, the strong interest of the transport industry in vertical takeoff transport planes due to short duration voyages, punctuality, regularity, and safety, is being considered. It is hoped that a greater equalization may be concluded from this study. This would make the vertical takeoff plane economically superior to the conventional transport airplane. A.S.

N63-10027 Deutsche Forschungsanstalt für Luft- und Raumfahrt. Inst. für Strahltriebwerke, Brunswick (W. Germany)
STRAHLDEFLEXION ZUR S/VTOL—SCHUBVEKTORSTEUERUNG [JET DEFLECTION FOR THE PURPOSE OF THRUST VECTOR CONTROL IN S/VTOL AIRCRAFT]
K. Grasmann 1962 35 p In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-11, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 29) Available from WGL, Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

The one-vector V/STOL jet propulsion system is compared to the multithrust vector system. Jet deflection represents a constructive possibility for the realization of a one-vector system. A quantitive evaluation of jet deflection can be made by means of measurements in model tunnels. The gas dynamic processes have a special significance in studies of this type and present new demands on the testing techniques. Several of these problems are explained and solutions given in this paper. Also, a series of systematic tests for jet deflectors is given. A.S.

N63-10028 Training Center for Experimental Aerodynamics, Rhode-Saint-Genèse (Belgium)
A PRELIMINARY INVESTIGATION ON V/STOL MODEL TESTING FOR GROUND PROXIMITY EFFECTS
P. E. Colin [1962] 19 p Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-11, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 30) Available from WGL,Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

A simple rig has been described with which it is possible to obtain data on ground proximity effects for V/STOL types of models in a more representative manner than in the wind tunnel when a fixed plate is used to represent the ground. A preliminary investigation conducted on a circular disc model with a centrally located jet has shown that substantial differences occur in the ground suction forces measured with the rig and measured in the wind tunnel, for rather small distances of the model from the plate. Within the scope of the present investigation, boundary layer thickness on the fixed plate in the wind tunnel does not appear to have a measurable effect on the ground suction forces induced by the jet. The main effect of the boundary layer is that it produces a change in the flow pattern and it is expected that this effect would depend essentially on model configuration. Author

N63-10029 Focke-Wulf, Bremen (W. Germany)
AUTOMATISCHE STABILIZIERUNG UND SICHERHEIT VON VTOL-FLUGZEUGEN [AUTOMATIC STABILIZATION AND SAFETY OF VTOL AIRCRAFT]
R. Staufenbiel and S. Girlatschek [1962] 37 p 3 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-11, 1962

(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 31) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

This paper describes studies and findings regarding stabilizing devices and systems that would offer greater safety during takeoff, landing, hovering flight, and transitional flight. The investigators believe that the problems introduced by the use of VTOL aircraft can be resolved without difficulty. With respect to suitable flight characteristics in hovering and transitional flight, it has been demonstrated that stabilization devices must be put into use. The use of this auxiliary apparatus for failure security makes this apparatus essential to the total security of the aircraft. A special Triplex System which may be obtained, and its relative cost, are described and proposed. A.S.

N63-10065 Rheinisch-Westfälische Technische Hochschule. Inst. für Turbomaschinen, Aachen (W. Germany)

DIE INKOMPRESSIBLE POTENTIALSTRÖMUNG IN DER EBENEN GITTERSTUFE [INCOMPRESSIBLE POTENTIAL FLOW IN THE PLANE CASCADE STAGE]

Heinz J. Oellers [1962] 9 p 4 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-12, 1962

(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 73) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

The singularity solutions for the single grating are extended to the double cascade (impeller and runner). System linear integral equations of the first order result for the turbulence or vortex shield of the various profiles. The intermittent or nonsteady flow is determined by approximation and the computation results, particularly for pressure distribution, are compared with those for the single grating. Trans. by A.S.

N63-10114 Applied Psychological Services, Wayne, Pa.

TED-NAM AV-43001, PART 7. HUMAN ENGINEERING INVESTIGATIONS OF AIRCRAFT COCKPIT VISUAL DISPLAYS. INVESTIGATIONS INTO FACTORS AFFECTING CONTROL ACTIVATION: VI. SUPPLEMENTAL STUDY OF TOGGLE SWITCH NUMBER AND DENSITY

Richard S. Lanterman, Douglas G. Schultz, and Arthur I. Siegel Philadelphia, Naval Air Material Center, Oct. 26, 1962 22 p 5 refs

(Contract N156-40376)

(NAMC-ACEL-488)

A study is made of the effects of varying the number and density of toggle switches on control activation time. The range of each of these factors was extended beyond that used in an earlier study in order to explore reasonable limits. Again, the time required to activate a series of toggle switches varied directly and linearly with the number of switches involved. With a small number of controls, the relationship between activation time and control density was found to be roughly linear but, as the number of controls increased and the between switch distance became large, a negatively accelerated curvilinear relationship became more apparent. Author

N63-10198 Princeton U., N. J.

A PRELIMINARY STUDY OF THE DYNAMIC STABILITY AND CONTROL RESPONSE DESIRED FOR V/STOL AIRCRAFT

David R. Ellis and Gregory A. Carter June 1962 91 p 9 refs

(Contract DA 44-177-TC-838)

(Rept. 611)

Analytical studies and fixed-base simulator experiments are carried out to determine the nature of the longitudinal dynamics and control response which become available when an aircraft is stabilized automatically and the pilot's controls are linked electrically to the autopilot. Pitch-attitude and pitch-rate feedbacks are found to be necessary if the pilot is to hover the machine with displacement information only. Groundspeed feedbacks are found to improve the response characteristics. It is shown that the effectiveness of any given feedback gains may be predicted by examining the characteristic roots of the aircraft and the closed-loop performance of the pilot-machine system. Author

N63-10200 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

TRANSITION AND HOVERING FLIGHT CHARACTERISTICS OF A TILT-DUCT VTOL RESEARCH AIRCRAFT

Henry L. Kelly Washington, NASA, Nov. 1962 43 p 7 refs (NASA TN D-1491) OTS: $1.25

Flight test results are presented which describe some aerodynamic characteristics of a tilt-duct vertical-take-off-and-landing research aircraft. Results include data from the transition speed range (35 knots to 115 knots) and some qualitative results in the hovering flight region. Author

N63-10219 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

LINEARIZED THEORY OF WIND-TUNNEL JET-BOUNDARY CORRECTIONS AND GROUND EFFECT FOR VTOL-STOL AIRCRAFT

Harry H. Heyson Washington, Superintendent of Documents, 1962 273 p 20 refs

(NASA TR T-124; For Tables of calculated interference factors see NASA TN D-933, NASA TN D-934, NASA TN D-935, and NASA TN D-936, N62-10016 01-02, N62-10017 01-02, N62-10018 01-02, N62-10019 01-02, respectively) GPO: $2.25

Interference factors are developed as a function of the degree to which the wake is deflected downward. At large wake deflections the interference may be much greater than indicated by classical theory. Methods are given for extending the present numerical results to tests involving multielement and finite-span models. The theory can be at least partially verified by means of available data. Tables of calculated interference factors are presented in NASA Technical Notes D-933, D-934, D-935, and D-936. Author

N63-10285 David Taylor Model Basin. Aerodynamics Lab., Washington, D. C.

PRELIMINARY STUDY OF HOVER PERFORMANCE OF A RAM-WING GEM

Gerald R. Barlow and Richard G. Huntington Oct. 1962 43 p 3 refs

(DTMB-AERO-1015; DTMB-1662)

The results of hover tests of a rectangular planform ram-wing ground-effect machine, utilizing wing-tip jets and leading-edge and trailing-edge flaps are presented. Several parameters were studied to determine optimum configurations for future ram-wing designs. The effects of aspect ratio, flap chord length, flap deflection angle, and jet nozzle angle were investigated. The results are presented as plots of augmentation factor versus ground proximity parameter. The results obtained indicate that for the configurations tested, the largest aspect ratio, the smallest flap chord length, and the smallest flap deflection angle give the lowest value of ground proximity parameter for a given augmentation. The optimum jet nozzle angle is between -60° and -72°. Author

N63-10297 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

METHODS OF SELECTION AND APPROXIMATE CALCULATION OF AIR DESIGN PARAMETERS

N. A. Fomin et al Sept. 27, 1962 116 p 21 refs Transl. from Aviats. Inst. im. Sergo Ordzhonikidze, Tr. (Moscow), no. 138, 1961 100 p

(FTD-TT-62-451/1+2+3+4)

671187 O - 63 - 2

A collection of papers is presented on the following problems in aircraft design: velocity of supersonic aircraft; selection of optimum number of turbojet engines; determination of fuselage slenderness-ratio; determination of wing weight; determination of the brake assembly design criteria; trim criteria for aircraft with tricycle landing gear; and calculation of the rigidity of the structural stiffening system. R.C.M.

N63-10479 United Aircraft Corp., East Hartford, Conn.
EXAMINATION OF THE ECONOMIC FEASIBILITY OF BOOST-GLIDE TRANSPORTS
A. A. LeShane Apr. 13, 1962 23 p 5 refs
(A-110052-5)

Boost-glide vehicles were examined for their potential economic feasibility in a commercial transportation system. Single- and two-stage vehicles utilizing both rocket and air-breathing engines for booster propulsion were analyzed. Performance and direct operating costs of boost-glide transports were estimated, and the design factors having the greatest influence on operating costs are discussed. Economic feasibility was examined by comparing direct operating costs of boost-glide vehicles with costs of cruise-type vehicles, including subsonic, supersonic, and hypersonic transports. Author

N63-10533 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROPELLER SLIPSTREAM EFFECTS AS DETERMINED FROM WING PRESSURE DISTRIBUTION OF A LARGE-SCALE SIX-PROPELLER VTOL MODEL AT STATIC THRUST
Matthew M. Winston and Robert J. Huston Washington, NASA, Dec. 1962 68 p 13 refs
(NASA TN D-1509) OTS: $1.75

An analysis has been made of static-pressure measurements on the wing and flaps of a general research model at zero free-stream velocity. For the tilt-wing configuration (zero flap deflection), the slipstream resulted in a spanwise variation in effective angle of attack of about 6° in a span of slightly less than 1 propeller diameter. For the deflected-slipstream configuration, the slipstream caused a 40-percent spanwise variation in effective thrust recovery and a 20° spanwise variation in effective thrust turning. Author

N63-10543 Toronto U. Inst. of Aerophysics (Canada)
CHARACTERISTICS OF A RECTANGULAR WING WITH A PERIPHERAL JET IN GROUND EFFECT PART II
James M. Davis May 1962 151 p 11 refs
(Contract AF 33(657)-8451)
(UTIA-TN-59)

Lift, drag, and pitching moment on a rectangular wing with a peripheral jet in proximity to ground were measured for various angles of attack, forward speeds, heights above ground, and two jet-exit angles. Flow visualization tests on the groundboard were also carried out. Results indicate that little, if any, loss of lift occurs as forward speed increases from zero. Considerable thrust augmentation was found at low heights above ground and negative angles of attack for one jet angle. Neutral stability occurred in hovering at practical heights above ground for the jet configuration at thirty degrees from the normal. A simplified estimate of the ground-run distance required for a Getol vehicle with the measured wing characteristics to reach takeoff speed was carried out for two heights above ground by considering the vehicle to have an installed thrust-to-weight ratio of 0.7. Shortest distances of 600 to 1200 feet resulted, depending on the height above ground for the two jet configurations investigated. Author

N63-10544 Toronto U. Inst. of Aerophysics (Canada)
GYROSTABILIZATION OF AN ELLIPTIC WING WITH PERIPHERAL JET HOVERING IN GROUND EFFECT
Jaan Liiva Aug. 1962 30 p 5 refs
(Supported by Defence Research Board of Canada)
(UTIA-TN-60)

Analog computations were performed to determine the effect of gyrostabilization on a hovering wing of elliptic planform. The criterion for sufficient rotor momentum to provide stability at heights in the unstable range of the undamped vehicle was found analytically. A constant rotor momentum 12% higher than the above was used throughout the computation. An initial disturbance was introduced and the resulting behavior of the vehicle was recorded by plotting angle of pitch against angle of roll, or both angles versus time. Three height regimes were investigated: small heights where moments above both axes were stable; intermediate heights where the moment derivatives about the pitch and roll axes are of opposite signs; and greater heights where both moments were unstable. Author

05 ASTRONOMY AND ASTROPHYSICS

Includes: celestial mechanics; and radioastronomy.

For related information see: 12 Geophysics; and 29 Space Sciences.

N63-10196 High Altitude Observatory, Boulder, Colo.
THE STRATOSPHERIC SOLAR AUREOLE Technical Report
John Allen Eddy (Ph.D Thesis U. of Colorado) 1961 142 p 65 refs
(Contract Nonr-393(05))

The spectral observations obtained on an unmanned balloon flight are reported and interpreted in terms of atmospheric aerosol content. The theory of light scattering by small particles is summarized to develop the formulae needed to interpret the aureole data. The apparatus employed in the balloon experiment is described in some detail; the principal instrument is an external occulting coronagraph called the flying coronagraph. The spectral observations are presented and described, and the limits of accuracy are discussed. Observations cover the wavelength range from 0.37μ to 0.79μ, at the scattering angle 2°.4, and over the altitude range from 42,000 ft. to 80,000 ft. The data are interpreted in terms of two atmospheric scattering components: a Rayleigh component due to atmospheric molecules, and a Mie component due to spherical aerosols. The findings suggest that the form of the particle-size distribution changes with altitude, becoming a steeper function of particle radius at higher altitudes. One of the allowed particle distributions is interpreted in terms of micrometeorites and an upper limit of meteoric flux is derived. Author

N63-10211 Technische Hochschule Hannover. Inst. für Theoretische Physik (W. Germany)
SELF-INTERACTION OF LONGITUDINAL PLASMA OSCILLATIONS WITH GENERATION OF ELECTROMAGNETIC RADIATION. APPLICATION TO THE NARROW-BAND RADIO BURSTS OF THE SUN. Technical Note No. 2
R. W. Larenz Jan. 7, 1962 15 p 10 refs Presented at the Symp. on Electromagnetic Theory and Antennas, Copenhagen, June 1962
(Contract AF 61(052)-161)

A short review is presented on longitudinal and transversal r.f. waves linearily coupled. The review points out the difficulty of separation of the transversal part to get radiation out of the plasma, and the lack of a substantial source of radiation, because these waves are representing free plasma wave modes. It is shown that nonlinear interaction of space charge waves yields a radiation source of pure transversal waves, which at the second harmonic of the plasma frequency can run through the plasma and leave it.

Formulas of the radiation field at large distances from the source are given and applied to the narrow band solar bursts. The observed exhibition of the second harmonic as well as the spectral energy distribution can easily be explained. Author

N63-10220 Virginia Polytechnic Inst., Blackburg

PHYSICS OF THE SOLAR SYSTEM, PART I. PROCEEDINGS OF THE CONFERENCE ON PHYSICS OF THE SOLAR SYSTEM AND REENTRY DYNAMICS, JULY 31 TO AUG. 11, 1961 Sponsored by NASA. Langley Research Center, and NSF

R. Grant Athey et al [1962] 226 p 266 refs

(Supported by NSF Grant)

In its Bulletin, Eng. Expt. Sta. Series No. 149, v. 55, no. 9, July 1962 VPI: $1.50

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15. RADAR STUDIES OF PLANETARY SURFACES G. H. Pettengill (Lincoln Lab.) p 210-236 33 refs (See N63-10227 01-05)
16. RADAR METHODS OF STUDYING DISTANT PLANETARY SURFACES John V. Evans (Lincoln Lab.) p 237-259 23 refs (See N63-10228 01-05)
17. RADAR MEASUREMENTS IN THE SOLAR SYSTEM G. H. Pettengill (Lincoln Lab.) p 260-266 11 refs (See N63-10229 01-05)

N63-10222 Commonwealth Scientific and Industrial Research Organization. Radiophysics Div., Chippendale, New South Wales (Australia)

SOLAR RADIO ASTRONOMY

Joseph L. Pawsey *In* Virginia Polytechnic Inst., Blacksburg. Physics of the Solar System, Part I. Proc. of the Conf. on Physics of the Solar System and Reentry Dynamics, July 31 to Aug. 11, 1961 p 40-66 25 refs (See N63-10220 01-05) VPI: $1.50

A general account is given of the observation of the sun using radio waves to point out the principle contributions of solar radio astronomy. The recognized types of solar radio emissions are discussed along with the instrumentation used to record each type. The mechanisms of solar radio emissions are reviewed and related to the structure of the solar atmosphere and solar flares. The principle contributions of solar radio astronomy are given as follows: (1) It has shown new phenomena associated with flares. (2) It has provided a very powerful Ne2 method for determining the structure of the solar atmosphere. (3) It has made contributions to radio technology in the high resolution field. (4) It has provided a strong stimulant to optical solar astronomy. R.C.M.

N63-10224 Smithsonian Astrophysical Observatory, Cambridge, Mass.

METEORITES: ORIGIN AND DISTRIBUTION

John A. Wood *In* Virginia Polytechnic Inst., Blacksburg. Physics of the Solar System, Part I. Proc. of the Conf. on Physics of the Solar System and Reentry Dynamics, July 31 to Aug. 11, 1961 p 78-109 28 refs (See N63-10220 01-05) VPI: $1.50

The distribution, analysis, and trajectory of meteorites is discussed to point out their possible origin. The most likely origin is shown to be the asteroid belt. The possibility of a "parent meteorite planet" is discussed on the basis of the composition and structure of the meteorites analyzed. R.C.M.

N63-10225 Lowell Observatory, Flagstaff, Ariz.

PHYSICS OF THE PLANETS

William M. Sinton *In* Virginia Polytechnic Inst., Blacksburg. Physics of the Solar System, Part I. Proc. of the Conf. on Physics of the Solar System and Reentry Dynamics, July 31 to Aug. 11, 1961 p 126-165 (See N63-10220 01-05) VPI: $1.50

Portions of this paper appear in The Moon—Its Astronomy and Physics. N. Y., Academic Press., 1961

Planetary physics is discussed in terms of observations made from the earth. The methods of observing the planets are reviewed. The data obtained are related to planetary surfaces and atmospheres. R.C.M.

N63-10228 Lincoln Lab., Mass. Inst. of Tech., Lexington

RADAR METHODS OF STUDYING DISTANT PLANETARY SURFACES

John V. Evans *In* Virginia Polytechnic Inst., Blacksburg. Physics of the Solar System, Part I. Proc. of the Conf. on Physics of the Solar System and Reentry Dynamics, July 31 to Aug. 11, 1962 p 237-259 23 refs (See N63-10220 01-05) VPI: $1.50

The techniques available to radar astronomy are reviewed to determine their usefulness in studying the roughness characteristics of lunar and planetary surfaces. It is shown that radar measurements yield information only about the presence of irregularities on the surface that have sizes ranging from less than one to tens of wavelengths. Structures which are considerably smaller than the wavelength may never be detected and large structures may be examined only if they are not covered by smaller irregularities. It is concluded that the present techniques can only provide a measure of the fractional amount of surface which has a roughness of the same size as the wavelength and the average gradient of the remainder. R.C.M.

N63-10229 Lincoln Lab., Mass. Inst. of Tech., Lexington

RADAR MEASUREMENTS IN THE SOLAR SYSTEM

G. H. Pettengill *In* Virginia Polytechnic Inst., Blacksburg. Physics of the Solar System, Part I. Proc. of the Conf. on Physics of the Solar System and Reentry Dynamics, July 31, to Aug. 11, 1961 p 260-266 11 refs (See N63-10220 01-05) VPI: $1.50

The detectability of radar targets in the solar system is discussed along with the relative sensitivity of radar systems available

for measuring these targets. The use of radar to determine the Astronomical Unit is outlined and the problems of solar radar measurements are considered. R.C.M.

N63-10296 Air Force Cambridge Research Labs. Geophysics Research Directorate, Bedford, Mass.

LUNAR THERMAL EMISSION MEASUREMENTS

John P. Castelli and Carl P. Ferioli Sept. 1962 19 p 4 refs (AFCRL-62-882)

During two lunar eclipses, 15 March 1960 and 25 August 1961, simultaneous records of the lunar thermal emission at 1200 and 3100 mc were obtained with the 84-ft radio telescope of the USAF Sagamore Hill Radio Observatory. No change in lunar temperature was measured at either frequency during the eclipses. A simple, straightforward method is described to convert antenna temperatures to average disk temperatures of the moon; the latter were found to be 230° K at 1200 mc and 223° K at 3100 mc. Author

N63-10303 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

CERTAIN RESULTS OF ELECTROPHOTOMETRIC OBSERVATIONS OF THE OI, Na AND OH EMISSIONS AND THE CONTINUUM IN THE AIRGLOW

L. M. Fishkova and G. V. Markova Sept. 28, 1962 21 p 18 refs Transl. from Byul. Abastumani Astrophys. Obs., no. 24, 1959, p 161-173

(FTD-TT-62-1076/1+2)

The OI, Na, and OH emissions and the continuum in the airglow is studied by mean of electrophotometric observations. The intensity of infrared airglow radiation in the $\Delta\lambda$ 9000° to 10,550 Å range was measured systematically with the aid of an infrared electrophotometer. Data from these observations made it possible to establish the total absolute intensity of the following bands of atmospheric hydroxyl: OH(8-4), OH(3-0), OH(9-5) and OH(4-1). Intensity measurements of the λ5577[OI], $\lambda\lambda$6300 to 6364[OI], and 5890 Na were carried out with the aid of an electrophotometer consisting of an FEU-32 photomultipler with a bismuth-cesium photocathode and a direct current amplifier connected in a diferential cathode follower circuit based on a 6N2P double triode. J.R.C.

N63-10428 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

VENUSIAN AND LUNAR RADAR DEPOLARIZATION EXPERIMENTS

Gerald S. Levy and Danver Schuster Repr. from Astron. J., v. 67, no. 5, June 1962 p 320-326 12 refs

(NASA Contract NAS7-100)

(JPL-TR-32-245)

From March 10, 1961, to May 10, 1961, Venusian and Lunar radar measurements were made at the Goldstone Tracking Station of the Deep Space Instrumentation Facility as a portion of an interplanetary communications research program. Depolarization phenomena were investigated at an operating frequency of 2388 Mc using a circular polarizer unit for the transmitter and receiver antenna feeds. The normal mode of operation was to transmit right-hand secondary circular polarization (RCP) and receive left-hand secondary circular polarization (LCP); the procedure was reversed for comparative results. Mismatched polarization echo signal strengths (RCP to RCP and LCP TO LCP) were compared with matched strengths (RCP to LCP and LCP to RCP). The results indicated that Venusian depolarized signal strengths were down 10.7±2 db to 13.4±2 db from the matched strengths; the Moon's signal strength was down 11±2 db. If the depolarized component of about 12 db were produced by a reflection in which the transmitting and receiving circularly polarized antennas as well as the reflector remain fixed with respect to each other, the axial ratio of the elliptical polarization would be 4.5 db. The axial ratio was measured by installing a linear rotatable feed system in the receiving antenna. The axial ratio of the received signal from Venus was of the order of 1 db, but the signal was extremely noisy. The Lunar axial ratio was about 0.5 db. The overall results of the depolarization experiments indicated that the Venusian data were similar to those of the Moon (Lunar depolarization can be attributed to surface scattering); however, there were insufficient data to support firm conclusions. Author

06 AUXILIARY SYSTEMS

Includes: fuel cells and solar cells; gas turbines; hydraulic, pneumatic and electrical control systems and actuators; and inverters.

For primary propulsion systems see: 27 Propulsion.

For related information see: 08 Communications; 09 Electronics; 10 Facilities; 15 Instrumentation; and 22 Navigation and Guidance.

N63-10020 Institut für Luftfahrttechnik, Technische Hochschule, Darmstadt (W. Germany)

UNTERSUCHUNGEN ÜBER ZEITOPTIMALE WENDEMANÖVER VON ÜBERSCHALLFLUGZEUGEN [EXAMINATION OF THE TIME-OPTIMAL TURNING MANEUVER OF SUPERSONIC AIRCRAFT]

H. Spintzyk 1962 15 p 5 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-11, 1962

(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 22) Available from WGL, Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

A procedure is described for the computation of time optimal turning curves. Furthermore, several examples using a model airplane are given. The findings indicate that the optimal turning curves in the horizontal plane at supersonic velocities are curves with little variability in angular velocity, which are flown through with maximal thrust. In vertical maneuvers the optimal angular velocity is radically variable, whereby the rising angular velocity in general is so great that the flight and the boundary proportions $n = n_{max}$ and $c_A = c_{Amax}$ fade out. A.S.

N63-10063 Ernst Heinkel Flugzeugbau G.m.b.H. Entwicklungs-Abteilung, Munich (W. Germany)

PROBLEME BEI DER AUSLEGUNG EINES DYNAMISCH ÄHNLICHEN FLUGZEUGMODELLS [PROBLEMS IN THE DESIGN OF A DYNAMICALLY SIMILAR AIRPLANE MODEL]

R. Garr [1962] 24 p 2 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-12, 1962

(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 70) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

With modern aircraft construction methods, oscillation and vibration is of increasing importance. It is necessary to consider oscillation and vibration in the early planning of an airplane. The problem is faced by determining how flutter stability can be maximized prior to airplane construction. This paper investigates flutter stability, using airplane models, for a supersonic pursuit airplane. A.S.

N63-10180 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio

EXPERIMENTAL INVESTIGATION OF A 90° FLAT-PLATE MAGNETIC TRIODE FOR DIRECT ENERGY CONVERSION

Richard R. Cullom Washington, NASA, Nov. 1962 14 p 5 refs (NASA TN D-1532) OTS: $0.50

An approach to decreasing the interelectrode space charge of a magnetic triode was tested by using a shaped magnetic field

to improve triode performance. The shaped field was designed to restrict the electrons to circular orbits and thus to decrease electron-electron collisions and/or electron scattering. A percentagewise improvement in the triode output power was observed with the shaped magnetic field. This improvement in the performance, however, was not of sufficient magnitude to make this particular triode a practical energy converter because the grid power loss was of greater magnitude than the power output. Author

N63-10252 National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE DESIGN OF THE UNITED KINGDOM SCIENTIFIC SATELLITE SOLAR POWER SYSTEM

Fred C. Yagerhofer N. Y., Am. Rocket Soc. [1962] 27 p Presented at the ARS Space Power Systems Conf., Santa Monica, Calif., Sept. 25-28, 1962

(ARS Paper-2498-62) ARS: $0.50 members, $1.00 nonmembers

A description is presented of the electrical power system used in the International Ionospheric Satellite, S-51, jointly sponsored by the United Kingdom and the United States. For this cooperative effort, the British supplied the scientific experimental equipment while the Goddard Space Flight Center contributed the payload electronic instrumentation, the power supply, the satellite structure, and the ground station equipment. The satellite employs a flat solar cell configuration rather than the conventional shingled-modular type and utilizes an electrochemical cell as a one-year payload cutoff timer. Of particular note are the techniques used to obtain proper charge rate into the rechargeable nickel-cadmium batteries, the novel standby battery with automatic switching circuitry and the precision static dc to dc conversion equipment. Author

N63-10253 Electro-Optical Systems, Inc., Pasadena, Calif.

SOLAR ENERGY THERMIONIC CONVERSION SYSTEM

W. R. Menetrey and A. Smith (Jet Propulsion Lab.) N. Y., Am. Rocket Soc. [1962] 106 p Presented at the ARS Space Power Systems Conf., Santa Monica, Calif., Sept. 25-28, 1962

(ARS Paper-2499-62) ARS: $0.50 members, $1.00 nonmembers

A discussion is presented of the fabrication and performance of a 5-ft solar concentrator, fabrication and test of 40 SET thermionic converters, and the fabrication of 2 SET thermionic generators, along with test data using both solar radiation and electron bombardment heaters. A system efficiency of 3 percent and a specific weight of 2 watts/lb was demonstrated in the first prototype system test using solar radiation. Author

N63-10254 Thompson Ramo Wooldridge, Inc., Cleveland, Ohio

SUNFLOWER THERMO-DYNAMIC POWER SYSTEM DEVELOPMENT STATUS

J. A. Rudy and J. W. Picking N.Y., Am. Rocket Soc. [1962] 12 p Presented at the ARS Space Power Systems Conf., Santa Monica, Calif., Sept. 25-28, 1962

(ARS Paper-2502-62) ARS: $0.50 members, $1.00 nonmembers

This presentation summarizes the status of the individual components which comprise the Sunflower system. The major components of the system have successfully undergone static ground performance testing with the exception of the full-scale solar collector. The most recent confirmation was obtained on the turboalternator, the second copy of which was put on test on May 23, and has accumulated more than 2000 hours of continuous operation. Author

N63-10255 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

SOLAR-CELL POWER SYSTEMS TESTING

John A. Zoutendyk N. Y., Am. Rocket Soc. [1962] 45 p 7 refs Presented at the ARS Space Power Systems Conf., Santa Monica, Calif., Sept. 25-28, 1962

(ARS Paper 2504-62) ARS: $0.50 members, $1.00 nonmembers

The use of high-altitude balloon flights in determining the earth space short-circuit current of solar cells is discussed. The application of balloon flight measurements to the determination of solar-cell spectral correction factors is outlined. Author

N63-10256 General Electric Co. Missile and Space Vehicle Dept., Philadelphia, Pa.

THERMAL ENERGY STORAGE FOR THERMIONIC CONVERSION

E. F. Batutis and D. L. Purdy N.Y., Am. Rocket Soc. [1962] 78 p 15 refs Presented at the ARS Space Power Systems Conf., Santa Monica, Calif., Sept. 25-28, 1962

(ARS Paper 2505-62) ARS: $0.50 members, $1.00 nonmembers

Silicon and a number of refractory oxide mixtures were studied in an investigation of materials having the properties of high heat of fusion (weight basis) and melting temperatures ranging from 1600° to 2200° K. These thermal energy storage (TES) materials were examined for usage in solar collector-thermionic converter electrical power systems employed in space vehicles. A series of screening tests for silicon containment materials were conducted and indicated that pyrolytic graphite, boron nitride, titanium boried and several other materials might be useful. Alternate TES materials in the form of eutectic oxides were uncovered which had heats of fusion near or better than silicon. Fabrication and sealing problems of the silicon container materials have shifted emphasis to the oxides. A system study was undertaken using the oxides as part of a solar thermionic electric power system. Calculated specific system weights ranged from 185 to 285 pounds per kilowatt with $4BeO\text{-}4MgO\text{-}Al_2O_3$ and $3BeO\text{-}2CaO$ respectively. The higher operating temperatures possible using oxides was the major parameter resulting in specific system weights lower than that calculated for silicon earlier. Author

N63-10257 Gulton Industries, Inc., Metuchen, N.J.

HERMETICALLY SEALED NICKEL-CADMIUM BATTERIES FOR THE ORBITING ASTRONOMICAL OBSERVATORY SATELLITE

R. C. Shair and W. Gray (Grumman Aircraft Engineering Corp.) Rocket Soc. [1962] 9 p Presented at the ARS Space Power Systems Conf., Santa Monica, Calif., Sept. 25-28, 1962

(ARS Paper-2508-62) ARS: $0.50 members, $1.00 nonmembers

Nickel-cadmium batteries are described for use in the Orbiting Astronomical Observatory satellite. The electrical design of the battery package consists of three strings of 22 cells each. One string will operate the equipment while the two redundant strings are available as standby batteries, which increases the reliability of the total battery package. When the operating battery falls below 22.0 volts, one of the standby batteries is switched into operation. Electrical and environmental tests of the battery package indicate a probability in excess of 99% that the battery will perform its function for the prescribed 7000 cycles. R.C.M.

N63-10258 National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

USE OF A SEALED SILVER CADMIUM BATTERY ON EXPLORER XII

T. J. Hennigan and A. O. Apelt N.Y., Am. Rocket Soc. [1962] 6 p Presented at the ARS Space Powers Systems Conf., Santa Monica, Calif., Sept. 25-28, 1962

(ARS Paper-2509-62) ARS: $0.50 members, $1.00 nonmembers

Due to the fact that silver cadmium cells could be constructed entirely free of magnetic materials, a secondary silver cadmium battery was used on Explorer XII, a satellite launched in 1961 to study radiation and magnetic fields. A program was carried out at Goddard Space Center to determine the feasibility of using the battery in this space application. Major points of interest of this program are presented. The operation of the power system on Explorer XII is outlined and cycling data, telemetered from the satellite, are presented. The first application of a silver cadmium battery on a satellite was very satisfactory. While in flight, no deterioration of the battery power supply was observed. Author

N63-10259 National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE BATTERY FOR THE INTERNATIONAL IONOSPHERE SATELLITE ARIEL I

Eugene R. Stroup N.Y., Am. Rocket Soc. [1962] 21 p Presented at the ARS Space Power Systems Conf., Santa Monica, Calif., Sept. 25-28, 1962

(ARS Paper-2510-62) ARS: $0.50 members, $1.00 nonmembers

This paper describes the development of an improved rechargeable, nickel-cadmium battery for spacecraft. It was designed for the S-51 International Ionospheric Satellite, also known as the UK-1 or Ariel I. Innovations including a ceramic-to-metal hermetically sealed case and pellon-plate separators are discussed. The six-ampere-hour, secondary battery selected for this satellite was an early product of the joint research and development program for battery improvement sponsored by NASA and industry. This battery incorporated the latest advancements in the state-of-the-art for spacecraft secondary batteries at the time of launch on April 26, 1962. Author

N63-10260 National Aeronautics and Space Administration, Washington, D.C.

THE NASA NUCLEAR ELECTRIC POWER PROGRAM

Fred Schulman N.Y., Am. Rocket Soc. [1962] 12 p Presented at the ARS Space Powers Systems Conf., Santa Monica, Calif., Sept. 25-28, 1962

(ARS Paper-2522-62) ARS: $0.50 members, $1.00 nonmembers

The nuclear electric power plants now in use or in development are described to indicate the current capabilities and project future requirements. The Snap-2 and the Snap-8 power sources are discussed along with the possible effects of the space environment on these systems. The estimated power requirements through 1967 are given, and the possibility of fulfilling these requirements with advanced systems, such as thermionic converters, is considered. R.C.M.

N63-10261 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

STATUS OF SOLAR ENERGY COLLECTOR TECHNOLOGY

Atwood R. Heath, Jr. N.Y., Am. Rocket Soc. [1962] 11 p 13 refs Presented at the ARS Space Powers Systems Conf., Santa Monica, Calif., Sept. 25-28, 1962

(ARS Paper 2531-62) ARS: $0.50 members, $1.00 nonmembers

A survey of solar energy collector technology is presented to point out the major areas of accomplishment. One-piece electroformed nickel collectors that closely approach the theoretical concentrating ability have been fabricated. The unit weights of these collectors fall in the range of 0.90 to 1.00 lb/ft² and, while their delivered energy per pound is low, they are capable of attaining higher absorber temperatures (over 4,000° R) than lighter collectors. The concentrating ability of the lighter reflectors, such as petal, Frensnel, inflatable, and inflatable-rigidized, falls in the range of 500 to 5000, which makes them suitable for lower temperature requirements (around 2000° R). The unit weights range from 0.03 lb/ft² for the inflatable to 0.46 lb/ft² for the Frensnel. The inflatable type delivers 1200 watts/lb at 2000° R while the petal models yield around 375 watts/lb. R.C.M.

N63-10262 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio

MATERIALS PROBLEMS ASSOCIATED WITH THE DESIGN OF RADIATORS FOR SPACE POWERPLANTS

James H. Diedrich and Seymour Lieblein N.Y., Am. Rocket Soc. [1962] 58 p 17 refs Presented at the ARS Space Powers Systems Conf., Santa Monica, Calif., Sept. 25-28, 1962

(ARS Paper-2535-62) ARS: $0.50 members, $1.00 nonmembers

The basic radiator problem related to space powerplants is reviewed. Two basic radiator types (tubular and nonfluid) are discussed, together with their associated essentials of construction. The effects of environmental factors, and design and operating conditions on the selection of radiator materials are enumerated. A comparison of specific materials is made, and the problem areas associated with their use in space radiators are discussed. The major conclusion reached indicates the need to develop design and fabrication technologies for relatively brittle materials as well as the need to accurately determine the behavior of such materials under space operating conditions. Author

N63-10263 Space Technology Lab., Inc., Redondo Beach, Calif.

EFFECT OF SPACE ENVIRONMENT ON PHOTOVOLTAIC CELLS

J. M. Denney, R. G. Downing, and G. W. Simon N.Y., Am. Rocket Soc. [1962] 8 p 10 refs Presented at the ARS Space Power Systems Conf., Santa Monica, Calif., Sept. 25-28, 1962

(Supported by NASA)

(ARS Paper-2536-62) ARS: $0.50 members, $1.00 nonmembers

A series of theoretical calculations have been performed concerning inelastic nuclear interactions between incident high energy protons and silicon. The results of these calculations, summarized here, indicate that, above incident proton energies of about 20 Mev, the primary defect production mechanism is inelastic nuclear interactions. Additional evidence is presented which indicates that the defect structures produced by these inelastic nuclear interactions are significantly more complicated than those produced by electron and lower energy proton induced elastic nuclear interactions. Based on these phenomena, it is shown that high energy proton experimental damage data on silicon photovoltaic devices obtained at low illumination intensities cannot be applied directly to spacecraft photovoltaic power supply systems designed to operate at the illumination levels existing in space. Author

N63-10264 Pratt and Whitney Aircraft, East Hartford, Conn.

THE EMITTANCE OF MATERIALS SUITABLE FOR USE AS SPACECRAFT RADIATOR COATINGS

W. H. Askwyth, R. J. Hayes, and G. Mikk N.Y., Am. Rocket Soc. [1962] 26 p 5 refs Presented at the ARS Space Power Systems Conf., Santa Monica, Calif., Sept. 25-28, 1962

(Sponsored by NASA)

(ARS Paper-2538-62) ARS: $0.50 members, $1.00 nonmembers

Various test facilities were used for routine measurements of total hemispherical emittance, at high vacuum, over a wide range of temperatures. Total hemispherical emittance was obtained in vacuum by measuring the electrical power dissipated per unit area in a metal tube or strip (using direct electrical resistance heating) and comparing this to the emissive power of a black body at the temperature of the test piece. Total hemispherical emittance was determined for approximately 100 samples at temperatures which varied from 200° F to 2200° F for some of these samples. The temperature range most frequently investigated was 300° F to 1450° F with particular emphasis on temperatures of 1350° F and 1450° F. The tests were conducted at vacuum levels which varied between 10^{-4} and 10^{-9} mm Hg. The test samples were usually coated metal strips or coated thin-walled metal tubes. Several coating methods were used but emphasis was placed on plasma arc spraying and aluminum phosphate bonding. Only those materials which show promise as being suitable for high temperature spacecraft radiators are discussed. These materials are divided into three groups; titania bearing oxides; oxides of nickel, chromium, and iron; and a miscellaneous group which includes boron, boron carbide, silicon carbide and acetylene black. In addition to determining emittance as a function of temperature, many of these materials were maintained in high vacuum at constant temperature (usually 1450° F) for periods of several hundred hours. This was to observe changes in emittance, if any, resulting from a prolonged exposure to high vacuum at these temperatures, as well as to observe possible deterioration of the coating-substrate bond. Author

N63-10265 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio

METEOROID PROTECTION FOR SPACE RADIATORS

I. J. Loeffler, Seymour Lieblein, and Nestor Clough N.Y., Am. Rocket Soc. [1962] 56 p 23 refs Presented at the ARS Space Powers Systems Conf., Santa Monica, Calif., Sept. 25-28, 1962 (ARS Paper-2543-62) ARS: $0.50 members, $1.00 nonmembers

The meteoroid damage problem for space radiators is reviewed to point out possible approaches to the problem. Relations for predicting required thickness of armor protection are given for isotropic incident flux, and a uniform calculation procedure for design studies is proposed. The advantages of controlled radiator orientation to take advantage of the directional properties of meteoroids are also analyzed. R.C.M.

N63-10266 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio

ANALYSIS OF A MEGAWATT LEVEL DIRECT CONDENSER-RADIATOR

Richard P. Krebs, David M. Winch, and Seymour Lieblein N.Y., Am. Rocket Soc. [1962] 47 p 13 refs Presented at the ARS Space Power Systems Conf., Santa Monica, Calif., Sept. 25-28, 1962 (ARS Paper-2545-62) ARS: $0.50 members, $1.00 nonmembers

An analytical study of a nonredundant direct condensing finned-tube radiator for a one megawatt Rankine electrical power generating system shows that the radiator weight may be close to 6000 pounds. This radiator was assumed to use beryllium fins and armor over a columbium alloy tube liner. Protection against damage from meteoroid impact, for the criteria used, constituted the major portion of the total weight. The study indicates the effect of tube diameter, number of tubes, and segmentation into nonredundant panels on the radiator weight and pressure drops. Header weights are of such magnitude that they should be considered in radiator design and analysis. Application of nonredundant segmentation results in some weight saving. Author

N63-10267 General Electric Co. Space Power and Propulsion Section, Cincinnati, Ohio

ALKALI METAL TWO PHASE HEAT TRANSFER FOR SPACE POWER—PRESENT STATUS

R. D. Brooks and S. G. Sawochka N.Y., Am. Rocket Soc. [1962] 28 p 22 refs Presented at the ARS Space Power Systems Conf., Santa Monica, Calif., Sept. 25-28, 1962 (NASA Contract NAS5-681) (ARS Paper 2547-62) ARS: $0.50 members, $1.00 nonmembers

A model for film boiling based upon the Prandtl mixing length concept has been derived. Forced convection boiling data in tubes have been obtained, and both nucleate and film boiling have been observed. Heat fluxes up to 600,000 Btu/hr ft^2 have been achieved in stable, nucleate boiling. Data for condensation of potassium is also presented. Flow stability for two-phase flow is briefly discussed. Typical instability observations for a boiling liquid metal loop are presented and the method of correction indicated. Author

N63-10268 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio

AN INSTABILITY EFFECT ON TWO-PHASE HEAT TRANSFER FOR SUBCOOLED WATER FLOWING UNDER CONDITIONS OF ZERO GRAVITY

S. Stephen Papell N.Y., Am. Rocket Soc. [1962] 11 p 5 refs Presented at the ARS Space Power Systems Conf. Santa Monica, Calif., Sept. 25-28, 1962 (ARS Paper-2548-62) ARS: $0.50 members, $1.00 nonmembers

Subcritical subcooled boiling heat-transfer data were obtained for distilled water flowing through a resistance heated tube in a gravity-free environment of approximately 15 seconds. Two distinct types of flow models were found to exist under identical test conditions. An instability, initiated by a momentary interruption of flow, forced the transition from a highly subcooled bubbly flow to a postulated slug type phenomenon, resulting in a 16-percent increase in local heat-transfer coefficients. The slug flow regime was described as consisting of two phases in a highly nonequilibrium thermodynamic state. A duplication of test conditions that produced the transition in a zero-gravity environment failed to do so under normal gravity conditions. Author

N63-10269 General Dynamics Corp. General Atomic Div., San Diego, Calif.

EXPERIMENTAL RESULTS ON SELECTION OF THERMIONIC CATHODES FOR REACTOR APPLICATION

Ling Yang, A. F. Weinberg, F. D. Carpenter, and R. G. Hudson N.Y., Am. Rocket Soc. [1962] 16 p 5 refs Presented at the ARS Space Power Systems Conf., Santa Monica, Calif., Sept. 25-28, 1962 (NASA Contract NAS5-1253; Contract AT(04-3)-167) (ARS Paper-2550-62) ARS: $0.50 members, $1.00 nonmembers

Two arrangements of thermionic emitters with uranium-bearing fuel elements are being investigated for application in the direct conversion of fission heat to electricity. They are (1) uranium-containing carbides which serve as both fuel element and emitter, and (2) refractory metal emitters clad around uranium-containing fuel. Both types must meet the nuclear requirements of a reactor fuel element as well as the thermionic requirements of a power converter. For carbide cathodes, material loss by vaporization and emission degradation from surface changes are the factors which determine converter life and performance. For refractory-metal-clad cathodes, the diffusion of the components of the fuel into the clad and degradation of emission from cathode surface contaminative are the critical factors. This paper discusses these aspects on the basis of existing experimental data. Author

N63-10270 Electro-Optical Systems, Inc., Pasadena, Calif.

ELECTRICALLY-REGENERATIVE HYDROGEN-OXYGEN FUEL CELL

Harvey A. Frank N.Y., Am. Rocket Soc. [1962] 5 p Presented at the ARS Space Power Systems Conf., Santa Monica, Calif., Sept. 25-28, 1962 (Sponsored by NASA) (ARS Paper-2563-62) ARS: $0.50 members, $1.00 nonmembers

A description is presented of the status of electro-optical systems in the development of an electrically regenerative hydrogen-oxygen fuel cell for space application. The system performs the same function as a secondary battery in spacecraft, and shows potential advantages over batteries from standpoints of energy-to-weight ratio, cycle life, and operating temperature range. Author

N63-10271 Eagle-Picher Co., Joplin, Mo.

THE CAPABILITY OF THE CADMIUM-SILVER OXIDE SYSTEM

J. F. Dittmann N.Y., Am. Rocket Soc. [1962] 6 p Presented at the ARS Space Power Systems Conf., Santa Monica, Calif. Sept. 25-28, 1962 (ARS Paper-2564-62) ARS: $0.50 members, $1.00 nonmembers

Investigative studies conducted on the cadmium-silver oxide system have demonstrated the feasibility of operating both sealed and vented batteries at the two capacity levels of the positive plate. Operation of a sealed cell at its maximum positive plate capacity over a period of long cycle life is presently limited by the inability of maintaining the silver dioxide level without experiencing excessive internal pressures at practical charging rates. Operating the sealed cadmium-silver oxide cell at the lower capacity level of the positive plate offers several important advantages in achieving extremely long cycle life. However, it is realized that to attain long cycle life by this method, a sacrifice must be made in energy output per unit weight and volume. By subjecting sealed cells to various conditions of cycling, it has been demonstrated that the cadmium-silver oxide system has a potential of attaining greater energy output in watt-hours per pound for longer periods of cycling than other systems currently in use. Author

N63-10272 Harshaw Chemical Co., Cleveland, Ohio
THIN FILM CdS FRONT WALL SOLAR CELLS
F. A. Shirland, T. A. Griffin, and G. H. Dierssen N.Y., Am. Rocket Soc. [1962] 8 p 5 refs Presented at the ARS Space Power Systems Conf., Santa Monica, Calif., Sept. 25-28, 1962
(ARS Paper-2566-62) ARS: $0.50 members, $1.00 nonmembers

A new photovoltaic cell made from a film of CdS vacuum evaporated onto a metal foil substrate is described. Such cells are being made in sizes up to 3-in × 3-in, at conversion efficiencies of 2 to 3%. They can be laminated in plastic envelopes to form arrays delivering 10 to 15 watts per pound. It is estimated that these cells can be made very economically. Typical I-V characteristic, spectral response, and temperature performance curves are given. Data on the stability of these front wall CdS cells, including resistance to radiation damage, are also presented. Possibilities for larger area, lighter weight, higher efficiency cells of this design are discussed. Author

N63-10273 Electro-Optical Systems, Inc., Pasadena, Calif.
A NEW RADIATION DAMAGE RESISTANT SOLAR CELL
S. Kaye, I. Weiman, and W. V. Wright N.Y., Am. Rocket Soc. [1962] 24 p 8 refs Presented at the ARS Space Power Systems Conf., Santa Monica, Calif., Sept. 25-28, 1962
(NASA Contract NAS7-92)
(ARS Paper 2567-62) ARS: $0.50 members, $1.00 nonmembers

The design and performance of an experimental silicon p-n junction solar cell intended for space application is described. The cell has an n-type surface layer and has an impurity gradient in the p-type base region. The gradient is such as to provide an electric field in the base region which will accelerate photoelectrons into the vicinity of the p-n junction. By this means, the dependence of the short circuit current upon the minority carrier lifetime is reduced. Since this latter parameter is the one most affected by bombardment of the cell by energetic charged particles, the tolerance of the cell to damage by such particles is considerably enhanced. Author

N63-10274 Thermo Electron Engineering Corp., Waltham, Mass.
CESIUM THERMIONIC CONVERTERS AND GENERATORS FOR SOLAR SPACE POWER SYSTEMS
Pierre J. Brosens and Sotiris S. Kitrilakis N.Y., Am. Rocket Soc. [1962] 10 p 7 refs Presented at the ARS Space Power Systems Conf., Santa Monica, Calif., Sept. 25-28, 1962
(Sponsored by ARPA, ONR, AFCRL, ASD, JPL, and AEC)
(ARS Paper-2571-62) ARS: $0.50 members, $1.00 nonmembers

The research work on thermionic converters accomplished at Thermo Electron is reviewed. Data obtained for converters, using niobium, tantalum, tungsten, iridium, and rhenium emitters, as a function of interelectrode spacing and converter operating temperatures is given in the form of maximum power density maps. Where pertinent, references to the original publications are given. Theoretical work on the effect of crystallographic orientation of emitter surface on converter performance is described. General design requirements for solar thermionic generators for space applications are discussed. Generators can be designed to have the fast warm-up characteristics that must be achieved in satellite applications. Work done at Thermo Electron on cylindrical monodiode and cubical multidiode generators is described. Although no inherent limitation has been observed on the life and reliability of thermionic devices, life of the order of several thousands of hours and higher reliability must be and remains to be demonstrated. Author

N63-10309 Martin Co., Nuclear Div., Baltimore, Md.
SNAP 7 PROGRAM: TASK 8—STRONTIUM-90 FUELED THERMOELECTRIC GENERATOR DEVELOPMENT Quarterly Progress Report No. 6, Feb. 1, 1962-Apr. 30, 1962
W. A. McDonald [1962] 24 p refs
(Contract AT(30-3)-217)
(MND-P-2483-6) AEC: $0.50

Work on the SNAP-7 Program continues with the assembly and test of 60-watt thermoelectric generators, the procurement of system components for SNAP-7D, and the installation and checkout of the strontium-90 isotope process equipment. R.C.M.

N63-10422 Cook Electric Co. Inland Testing Labs., Dayton, Ohio
ALKALINE BATTERY EVALUATION [Third Semi-Annual Report, Oct. 15, 1961-April 15, 1962]
W. W. Clark, W. G. Ingling, and I. F. Luke Wright-Patterson AFB, Ohio, Flight Accessories Lab., [1962] 122 p 5 refs
(Contract AF 33(616)-7529)
(ASD-TDR-62-553; supersedes ASD-TD-62-68)

Cycle-life tests have been conducted on one type of 12 ampere-hour, sealed nickel-cadmium cells in four temperature environments and four depths of discharge, in groups of 10 cells and in batteries of 20 cells. Initial results in the program show that: (1) cell cycle-life with shallow discharges is considerably longer than cycle-life at deep discharges and (2) cycle-life is reduced by high and low ambient temperatures. Author

N63-10438 General Dynamics Corp. General Atomic Div., San Diego, Calif.
FLAT-PLATE SOLAR THERMOELECTRIC CONVERSION PANELS [Final] Technical Documentary Report [Nov. 1960-Dec. 1961]
Arthur N. Himle, Daniel S. Brush, John B. Roes, and Edward L. Brady Wright-Patterson AFB, Ohio, Flight Accessories Lab., May 1962 53 p 3 refs
(Contract AF 33(616)-7676)
(GA-2823; ASD-TDR-62-214)

Procedures have been developed for the construction of a lightweight solar energy converter, using thermoelectric materials sandwiched between flat sheets of aluminum. Two panels, each one foot square, have been delivered to the Flight Accessories Laboratory, Aeronautical Systems Division. Each panel contains 153 n-type PbTe elements and 153 p-type ZnSb elements, arranged in eighteen alternating rows of seventeen elements each. According to measurements made on test panels constructed in a similar fashion, the delivered panels are capable of an output of at least 1.33 w/ft² when subjected to an incident energy of 1400 w/m², which is equal to the solar energy intensity at the earth's distance from the sun. At this output, the solar panel weighs 96 pounds per electrical kilowatt. The observed output is lower than is calculated from the properties of the materials used; however, it is anticipated that improved performance can be obtained in future panels. Author

N63-10452 Ford Instrument Co. Nuclear Development Div., Long Island City, N.Y.
LO-TEMP THERMIONIC PLASMA STUDY Yearly Summary Technical Report
W. G. Stenzel Jan. 31, 1962 62 p refs
(Contract Nonr 3416(00))

Measurements of electron temperature, electron concentration and space potential in the plasma region of low temperature thermionic converters were determined by means of a pulsed Langmuir probe technique. The spatial distributions of these parameters, in parallel plate geometry, were measured with the aid of movable probes. The experimental values are shown to be consistent with a reasonable physical picture. Preliminary results obtained from converters, in which small amounts of oxygen were present in the discharge region, are explored. The effects of cesium and "patch effects" on the surface characteristics of impregnated tungsten emitters are discussed on the basis of a theoretical analysis and experimental results with numerous test cells. Author

N63-10480 ITT Federal Labs., Nutley, N.J.
FERROELECTRIC ENERGY CONVERSION [Final Report, Apr. 1961-Apr. 1962]

S. R. Hoh and F. E. Pirigyi Wright-Patterson AFB, Ohio, Flight Accessories Lab., June 1962 51 p 28 refs
(Contract AF 33(616)-7940)
(ASD-TDR-62-398)

A study was conducted to explore the usefulness of ferroelectric energy conversion for flight vehicle power supplies. The development of barium titanate-based materials was encouraging and fruitful. Ceramic sheets with very high values of polarization, permittivity, and insulation resistance were prepared. A new approach for introducing low valency anions such as fluorine simultaneously with high valency cations such as uranium proved successful and practical. The conversion efficiency does not exceed 1% with $BaTiO_3$-based compositions, but good specific outputs can be calculated for very thin ferroelectric films. Author

N63-10548 California U., Livermore. Lawrence Radiation Lab.
DESIGN AND CONSTRUCTION FEATURES OF A VARIABLE GAP THERMIONIC CONVERTER TUBE
W. H. Gust and E. S. McKee Sept. 27, 1962 14 p 1 ref
(Contract W-7405-eng-48)
(UCRL-7031) OTS: $0.50

Design and construction features are presented for a parallel-plane thermionic converter tube which has an interelectrode gap that may be precisely varied from zero to 6 inches. Author

N63-10558 Thompson Ramo Wooldridge, Inc. TAPCO Div., Cleveland, Ohio
THE SNAP II POWER CONVERSION SYSTEM TOPICAL REPORT NO. 13. ORBITAL FORCE FIELD BOILING AND CONDENSING EXPERIMENTS (OFFBACE)
C. T. Jaenke, Alfred Koestel, and John G. Reitz Oct. 1962 148 p 17 refs
(Subcontract N843FS-101221; prepared for Atomics International)
(ER-4670; NAA-SR-6305)

This report presents the results of a series of Orbital Force Field Boiling and Condensing Experiments, otherwise known as the OFFBACE Test Program. OFFBACE was undertaken to show the feasibility of operation of a mercury Rankine power system in a zero-gravity environment. A further purpose was to provide quantitative data concerning operation of the various components under zero-gravity conditions for future design consideration. Particular attention was paid to the condenser area since this component is very sensitive to gravity effects. The mechanics of condensing in gravity fields are developed from experiments conducted on mercury drops under both static and dynamic conditions. These observations are then compared with those obtained from the OFFBACE Mark II test apparatus both during ground testing and flight testing aboard the KC-135 aircraft. An attempt is made to establish the role played by gravity in the mechanics of two-phase flow. This gives the basis for analysis of operation of the SNAP II system in space by extrapolation of data obtained under gravitational influences. Author

07 CHEMISTRY

Includes: chemical analysis and identification (e.g., spectroscopy); chemical engineering; chemical properties of materials; and synthesis.

For related information see: 18 Materials, Metallic; 19 Materials, Nonmetallic; and 26 Propellants and Combustion.

N63-10090 National Cash Register Co. Fundamental Research Dept., Dayton, Ohio
A STUDY OF THE ENCAPSULATION APPLICABLE TO LIQUID ROCKET FUEL Interim Report No. 4, 1 July 1961 to 30 June 1962
Paul Y. Hsieh July 1962 54 p refs
(Contract Nonr-2848(00))

Interfacial polymerization is studied as a promising approach to the problem of encasing a liquid within a polymer wall. Some polymers were prepared by interfacial polymerization under conditions which could be directly translated or extrapolated to actual encapsulation processes. The polymerization must occur under mild conditions and proceed with reasonable reaction rates. The resulting polymer wall must be able to protect the internal phase and to exclude moisture. The polymers formed by interfacial polymerization do not exclude moisture well. However, it is considered possible to overcome this disadvantage by post treatment of polymers by crosslinking. The prime requirement that a polymer must fulfill is that it be compatible with the internal phase. To this objective, the compatibility of hydrazine with various commercial polymers was studied. J.R.C.

N63-10171 Stanford Research Inst., Menlo Park, Calif.
VAPOR PRESSURE OF AMMONIUM PERCHLORATE
S. Henry Inami, Willis A. Rosser, and Henry Wise [1962] 13 p 18 refs
(Supported by the Office of Naval Research)

The equilibrium vapor pressure of ammonium perchlorate has been measured in the temperature range of 520° to 620° K by the transpiration method. The data indicate that ammonium perchlorate sublimes by the dissociation process $NH_4ClO_{4(s)} = NH_{3(g)} + HClO_{4(g)}$. The heat of dissociation has been found to be 58 ± 2 kcal/mole in the cited temperature range. Author

N63-10195 International Union of Pure and Applied Chemistry
BIBLIOGRAPHY ON THE HIGH TEMPERATURE CHEMISTRY AND PHYSICS OF GASES AND GAS-CONDENSED PHASE REACTIONS, NO. 5
L. Brewer, comp. (U. of Calif.) Sept. 30, 1962 27 p 247 refs

This bibliography on high-temperature chemistry and physics includes information on the following: reactions between gases and condensed phases, and spectroscopy of interest to high-temperature chemistry. J.R.C.

N63-10210 Atomic Energy Commission. Div. of Technical Information, Washington, D. C.
PROBLEMS OF PHOTOSYNTHESIS: REPORTS OF THE SECOND ALL-UNION CONFERENCE ON PHOTOSYNTHESIS, MOSCOW, JANUARY 21-6, 1957
A. L. Kursanov, A. A. Nichiporovich, A. A. Krasnovskii, B. A. Rubin, E. A. Boichenko, and O. P. Osipova, eds. Aug. 1962 1049 p refs In 2 books Transl. by JPRS from the book "Problemy Fotosinteza; Doklady na II Vsesoyuznoĭ Konferentsii po Fotosintezu" Moscow, Acad. of Sci., U.S.S.R., 1959
(AEC-TR-4501) OTS: $11.00

This report on photosynthesis covers the following: photochemistry and spectroscopy of plastid pigments; formation, state and transformation of pigments in a plant; structure, biochemistry and chemistry of chloroplasts; mechanism and products of photosynthesis; photosynthesis of aqueous plants and microorganisms; physiology and ecology of photosynthesis; and growth of plants in artificial light. J.R.C.

N63-10214 Basel U. (Switzerland)
NEW ENERGY LEVELS OF THE NO-MOLECULE Technical Report
E. Miescher May 1962 10 p 4 refs
(Grant AF-EOARDC-61-19)
(AFCRL-62-1016)

The study of the absorption spectrum of nitric oxide (NO) is continued on high dispersion plates in the region below 1500 Å. Additional information is obtained for the recently identified states: $G^3\Sigma^-$, $H^3\Sigma^+$, $H'^3\Pi$, $I^3\Pi$, $P^3\Pi$. A consistent interpretation of the

observed Rydberg-states is given. NO-emission bands in high dispersion in the visible and infrared are also measured. Preliminary results confirm the interpretation of some as H, H' → A, C, D transitions. Author

N63-10323 William H. Johnston Labs., Inc., Baltimore, Md.
THEORETICAL STUDIES IN BASIC RADIATION CHEMISTRY [Final Technical Report, 14 Oct. 1960 - 15 Aug. 1962]
M. Vestal, A. L. Wahrhaftig, and W. H. Johnston Wright-Patterson AFB, Ohio, Aeronautical Research Labs., Sept. 1962 197 p 40 refs
(Contract AF 33(616)-7638)
(ARL-62-426) OTS: $3.00

The present studies were concerned with the problem of specifying the distribution of excited ions and molecules formed in gas phase radiation chemical systems. The principle emphasis was placed on developing and improving a satisfactory theory of unimolecular reactions of excited polyatomic molecule-ions; establishing the validity of the theory by comparing calculated results with published experimental data; and extending the theory for application to radiation chemistry. Consideration was also given to the problem of specifying the electron energy distribution producing the excitation and ionization in an irradiated gas phase system. Theoretical results are presented for propane, n-butane, and isobutane. These results include theoretical breakdown graphs, mass spectra, and ionization efficiencies. The effects on the unimolecular decay kinetics of fluctuations of energy between charged and neutral fragments, thermal energy, and electron energy distribution are included. Author

N63-10502 Wisconsin U. Theoretical Chemistry Inst., Madison
NON-UNIFORM SCALING OF AN APPROXIMATE H_2^+ WAVE FUNCTION
William J. Meath and Joseph O. Hirschfelder Oct. 29, 1962 13 p 13 refs
(Contract AF 33(657)-7311)
(WIS-TCI-4, Series 3)

The approximate wave function considered for the H_2^+ molecule is

$$\psi = N\left[\begin{array}{l}\exp\{-s\,[\gamma^2\,(x^2+y^2)+(z+R/2)^2]^{1/2}\} \\ +\exp\{-s\,[\gamma^2\,(x^2+y^2)+(z-R/2)^2]^{1/2}\}\end{array}\right].$$

Energy optimization of the nonuniform scaling parameter, γ, results in the satisfaction of the "one-coordinate" virial theorem

$$-(\hbar^2/2m)\int\psi(\partial^2/\partial x^2)\,\psi\,d\tau = (1/2)\int\psi x(\partial V/\partial x)\,\psi\,d\tau.$$

Similarly, the energy optimization of the uniform scaling parameter, s, results in the satisfaction of the usual virial theorem. The simultaneous application of these two types of scaling is also discussed. Author

N63-10549 General Electric Co. Flight Propulsion Lab. Dept., Cincinnati, Ohio
RESEARCH ON ANALYTICAL METHODS FOR OXYGEN IN LIQUID ALKALI METALS Quarterly Progress Report No. 7, July 1 - Sept. 30, 1962
Hyman Kirtchik and George Riechmann Oct. 15, 1962 13 p 2 refs
(NASA Contract NASr-12)
(DM-62-238) OTS: $1.60 ph, $0.80 mf

An analysis of a mixture of argon, fluorine, oxygen bifluoride, and oxygen is made to determine total oxygen content. Two different basic approaches were considered: to react the fluorine and oxygen bifluoride with mercury, and to react the fluorine and oxygen bifluoride with crystalline potassium iodide. It was observed that oxygen bifluoride reacts with platinum at 200° C to form platinum tetrafluoride and at 350° C forms platinum pentafluoride. In order to determine if this could be used for the purpose of converting OF_2 to oxygen, a small trap was packed with 40 grams of platinum wire and heated to 300° C. This technique gave biased results in that 25 of the 28 samples gave results higher than the theoretical value. J.R.C.

N63-10573 Gt. Brit. Ministry of Aviation. Technical Information and Library Services, Mottingham
THE FORMATION REACTIONS OF NITROXYCHLORIDE (BILDUNGSREAKTIONEN DES NITROXYCHLORIDS)
H. Martin Nov. 1962 5 p 11 refs Transl. from Angew. Chem., 1958, 70(4), 97-98
(TIL/T-5372)

Six ways are reported of forming NO_2Cl from ClO_2 or Cl_2O with NO_2 or N_2O_5. The reaction of Cl_2O with NO_2 in the molten state differs from that in the gas or solution phases. Reaction mechanisms are given for all the gas and solution reactions. The free radical OCl always occurs. Preparation of nitroxychloride in the pure state and some physical properties are described. Author

08 COMMUNICATIONS

Includes: communications equipment and techniques; noise; radio and communications blackout; telemetry; tracking; and

For tracking stations see: 10 Facilities.

For related information see: 06 Auxiliary Systems; 09 Electronics; 15 Instrumentation; and 22 Navigation and Guidance.

N63-10003 Lockheed Missiles and Space Co. Research Labs., Palo Alto, Calif.
TRENDS IN MISSILE AND SPACE RADIO TELEMETRY
Joachim W. Muehlner [1962] 45 p 24 refs Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-11, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 4) Available from WGL, Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

The development of concepts and equipment for telemetering systems of high data capacity and efficiency has progressed considerably during recent years. For the majority of data connected with large-scale rocket and space missions, the PAM/PCM-FM system is well suited because of its adaptability, economy of bandwidth and power, and ability to handle some high-accuracy data. If the bulk of the data to be transmitted demands high accuracy and/or the data format must be compatible with computing equipment aboard the space vehicle, PCM-FM is most appropriate. In any case, it becomes progressively more important to combat the flood of data descending on us from outer space. This can best be achieved by information bandwidth compression schemes based on elimination of redundancy. Techniques, such as are presently under development at Lockheed, lead to compression factors of the order of 30, referenced to the indiscriminate data-transmission practices of today. Author

N63-10037 Deutsche Versuchsanstalt für Luft- und Raumfahrt. Inst. für Flugfunk und Mikrowellen, Oberpfaffenhofen (W. Germany)
ZUR MESSUNG UND DARSTELLUNG DER RÄUMLICHEN STRAHLUNGSDIAGRAMME VON FLUGZEUGANTENNEN, INSBESONDERE ZUM PROBLEM DER POLARISATION [ON THE MEASUREMENT AND PRODUCTION OF A SPACE RADIATION DIAGRAM OF AIRCRAFT ANTENNAS AND PARTICULARLY THE PROBLEM OF POLARIZATION]

H. H. Mattes Sept. 10, 1962 23 p In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-11, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 41) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

An attempt is made to give insight into the problems of the measurement of space propagation characteristics of space vehicle antennas. The field pattern of the antenna aboard the vehicle must be measured and the field pattern of the measuring antenna on the ground must be known. It was demonstrated that the antenna of a vehicle in normal flight, because of polarization, does not always absorb the maximum possible field energy, and that this effect may be described by the use of a dependent field-strength correction factor. This factor, for the three most frequent cases appearing in practice, has been computed in Polar and Cartesian coordinates and the findings are discussed. A.S.

N63-10038 Deutsche Versuchsanstalt für Luft- und Raumfahrt. Inst. für Flugfunk und Mikrowellen, Oberpfaffenhofen (W. Germany)
ÜBER DAS STATISTISCHE VERHALTEN DER RADARECHOS VON FLUGZEUGEN [ON THE STATIC BEHAVIOR OF RADAR ECHOES FROM AIRCRAFT]
M. Vogel Sept. 10, 1962 25 p 3 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-11, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 42) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

The microwave-backscatter cross section of an airplane during flight is a fluctuating and variable quantity. This paper reports on the measurement and evaluation of frequency distribution, and frequency spectra for the airplanes and airplane models. Trans. by A.S.

N63-10040
SPEZIELLE PROBLEME DER SATELLITEN-NACHRICHTEN-UBERTRAGUNGSTECHNIK [SPECIAL PROBLEMS OF THE SATELLITE-NEWS-TRANSMISSION TECHNIQUE]
F. Vilbig [1962] 18 p 5 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-12, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 44) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

Factors discussed in regard to special problems of the Satellite-News-Transmission Technique are as follows: (1) radio signals of cosmic origin; (2) radio signals of earthly origin including "Störmer-Hals echoes" and whistler patterns; (3) echo signals from heavenly bodies including Moon echoes, echoes from Venus and the Sun, along with an investigation of charged particles in interstellar space; (4) echoes along meteor paths; (5) news relay with the aid of artificial satellites; (6) satellite orbits and their parameters; (7) Doppler effect as well as ionospheric and tropospheric influences upon wave expanse which in turn determines the broadcast frequency; (8) a depth-indicating equation for calculating satellite news communication, using both active and passive satellites; and (9) German contribution toward the construction of a universal satellite news communication system. Trans. by I.V.L.

N63-10083 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SELF-ERECTING SPACE ANTENNAS
W. F. Croswell, M. C. Gilreath, and V. L. Vaughn, Jr. Repr. from IRE Trans. on Space Electronics and Telemetry, v. SET-8, no. 2, June 1962 p 139-142 5 refs

A self-erecting technique for erectable space-vehicle antennas is proposed. Working models of Yagi disk antennas utilizing this new principle are described. Author

N63-10164 Wilcox Electric Co., Inc., Kansas City, Mo.
DESIGN AND DEVELOPMENT OF THE GENERAL AVIATION TRANSPONDER Final Engineering Report
Richard W. Donovan [July 18, 1962] 116 p
(Contract FAA/BRD-234)

The final effort on the design and development of a Air Traffic Control Transponder for General Aviation use is reported. The transponder operates in the L Band, incorporating a superheterodyne receiver and a grid-pulsed triode cavity transmitter. The unit decodes proper Mode A (8.0 usec) interrogations, and replies with a maximum of nine pulses (two framing pulses, six information pulses, and an identification (I/P) pulse). The receiver sensitivity is -74 dbm and the peak power output is 27 ± 3 db. The unit is contained in a short 3/8 ATR full height case, and weighs 10.5 lbs. The transponder is powered from either a 13.75 vdc or a 27.5 vdc source, and requires 32 watts at normal reply rates. Author

N63-10177 National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TRACKING SYSTEMS, THEIR MATHEMATICAL MODELS AND THEIR ERRORS. PART I - THEORY
F. O. Vonbun and W. D. Kahn Washington, NASA, Oct. 1962 47 p 7 refs
(NASA TN D-1471) OTS: $1.25

This paper treats the errors associated with the position and velocity of a satellite or spacecraft when tracked by all types of present day tracking systems. These errors are based upon uncertainties in measurements made with the systems as well as uncertainties in the systems' location on the earth. The subject of these errors is treated in two parts. The present paper is mainly a theoretical treatment which establishes the necessary mathematical models and the method employed for solving the errors. A rigorous derivation of the "Method of Least Squares" is also presented for completeness since it is used to a large extent. Author

N63-10249 Jet Propulsion Lab., Calif., Inst. of Tech., Pasadena
SYNCHRONIZATION OF TELEMETRY CODES
J. J. Stiffler Repr. from IRE Trans. on Space Electronics and Telemetry, June 1962 p 112-117 12 refs
(NASA Contract NAS7-100)
(JPL-TR-32-304)

A well-known means of efficiently transmitting information over the continuous white Gaussian channel involves the encoding of successive blocks of data into sequences of binary digits (called code words). Efficient decoding of these sequences in turn necessitates a knowledge of the instants in time at which one code word ends and the succeeding word begins. This paper presents a method for obtaining this synchronization which neither decreases the channel capacity nor increases the complexity of the encoding equipment. The method is to select, from the many encodings which are equally good for purposes of synchronous operation, that encoding for which the maximum absolute value of the correlation ρ_s between any code word and any sequence formed from the overlap of two code words is a minimum. Thus a large correlation is observed only in the synchronous phase position. This technique is applied to an important class of block codes, the binary orthogonal codes. An algorithm for constructing these codes with the desired self-synchronizing properties is presented, and upper bounds on the value of ρ_s are thereby established. Author

N63-10304 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio
ANTENNAS WITH CORRUGATED GUIDING SURFACE
S. Pogorzelski Sept. 19, 1962 17 p 2 refs. Transl. from Przemyslowy Inst. Telekomunikacji (Prace), v. 11, no. 32-33, 1961 p 65-71
(FTD-TT-62-1140/1+2)

A study is made of antennas with a corrugated guiding surface for the case of a flat surface wave TM running in a direction perpendicular to the edges of the corrugations. An approximate solution is given for the problem of antenna radiation. The problems concerning direction of maximum radiation, width of main leaflet and position of zero characteristic points are also analyzed. The effect of curvature of the guiding surface is discussed qualitatively. J.R.C.

N63-10313 Lockheed Missiles and Space Co., Sunnyvale, Calif.
INFRARED DIFFRACTION PATTERN SCANNING STUDY Final Report [Mar. 11, 1961-Sept. 1, 1962]
R. C. Redden, R. G. Clow, and R. P. Day Oct. 1962 283 p 37 refs
(Contract AF 04(647)-688; ARPA Order 153-60 Proj. DEFENDER) (SSD-TDR-62-157)

The central hypothesis of target-to-background discrimination by diffraction pattern scanning is that the target apparent size is identified with higher spatial frequencies in the Fourier transform of the optical scene, and a space filter (telescope with two-beam interference) that transmits the higher frequencies can be used to produce an electro-optical system with improved discrimination capabilities. An experimental program was conducted, both to test the hypothesis and to evaluate the feasibility of implementing the technique for practical applications to weapon systems. A theoretical study was conducted to analyze the hypothesis and to formulate general criteria and concepts for target-to-background discrimination. Mathematical models and descriptions of backgrounds were reviewed and analyzed, and a particular model was developed. The methods of Fourier analysis, matched filter theory, and statistical decision theory were applied to an electro-optical system concept. A practical optimum filter was specified. Experiments were conducted both in the visible and infrared spectra. A high-resolution infrared scanning telescope was designed and fabricated. Diffraction patterns from different sources and backgrounds were produced and detected by both infrared scanning and photographic recording. The theoretical predictions of an improvement in target-to-background discrimination over conventional systems were not tested sufficiently for final opinions, due to a need for outdoor tests. However, the experimental results on scanning the diffraction patterns of sources, large enough to exhibit partial coherency effects, were in agreement with theory. Author

N63-10339 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio
ON THE POSSIBILITY OF NOCTURNAL OPTICAL OBSERVATIONS OF ARTIFICIAL SATELLITES
G. G. Lengauer Sept. 17, 1962 57 p 24 refs Transl. from Izv. Glavnoi Astron. Observ. v Pulkove (Leningrad), v. 21, no. 6 (165) [1960] p 83-113
(FTD-TT-61-351/1+2+4)

A study has been made to determine the possibilities of using a searchlight to make nighttime observations of satellites. The light from the searchlight would be reflected back to the source by cataphotes on the satellite. Calculations have been made of the brightness of the background formed by the searchlight beam under several atmospheric conditions, and the corresponding limiting stellar magnitudes for a luminous point which is still visible against this background have been determined. These calculations show that with luminous intensity for the searchlight of 10^{10} candles and a beamwidth of 5°, a satellite can be observed at distances up to 500 km. R.C.M.

N63-10342 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio
PROPERTIES OF A DEFOCUSED ROTARY PARABOLOID
O. Klos, J. Musil, and L. Obruca Sept. 28, 1962 24 p 5 refs Transl. from Slaboproudy Obzor (Prague), v. 23, no. 1, 1962 p 39-45
(FTD-TT-62-1139/1+2)

A summary is presented of values pertaining to the properties of a defocused paraboloid, emanating from the analysis of data obtained on the basis of geometric optics. A description is given of two methods of studying the properties of a defocused paraboloid, the assignment of which it is to find optimum focusing of curve. Experimental verification is made of certain dependences on a trimmed rotary paraboloid with dimensions $23\lambda \times 53\lambda$ with focal distance $f = 20\lambda$ and on a wavelength $\lambda = 3.2$ cm. Author

N63-10399 General Dynamics/Astronautics, San Diego, Calif.
SPATIAL FILTERING
W. D. Montgomery and P. W. Broome *In* Air Force Systems Command. Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif. Transactions of the 7th Symp. on Ballistic Missile and Space Technol., U.S. Air Force Academy, Colo., Aug. 13-16, 1962 Vol. II p 321-357 8 refs (See N63-10389 01-01)
(Contract AF 04(647)-644)

Spatial filtering of two-dimensional pictorial data as an extension of one-dimensional filter theory is applied to the problem of enhancing the detection of localized objects which are superimposed upon a noisy background. Four types of filters are derived. These are the Linear, Quadratic, General Statistical, and Decision filters. Each filter is of the "matched" type, the different designs being associated with various degrees of knowledge about the noise statistics. A computer simulation of the linear and general statistical filters was done and examples are shown. Author

N63-10402 Planning Research Corp., Los Angeles, Calif.
A STUDY OF THE MULTISATELLITE CONTROL PROBLEM
Y. Fukuda, G. R. Grainger, and A. W. Corry *In* Air Force Systems Command. Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif. Transactions of the 7th Symp. on Ballistic Missile and Space Technol., U.S. Air Force Academy, Colo. Aug. 13-16, 1962 Vol. II p 415-441 1 ref (See N63-10389 01-01)

The multisatellite control problem is concerned with control of a system of orbiting satellites, each with specific requirements for service. Service is supplied in the form of tracking, readout, and command by a system of ground stations. This paper documents a method of solution to the problem. This method, called the "horizontal method," is based on the concept of sequentially selecting each service requirement and then sequentially making service assignments over the entire scheduling period. The method is capable of handling any number of satellites, services, and ground stations, and is amenable to graphic implementation for small systems. Large systems will require an electronic computer program to implement a schedule devised by the method. Author

N63-10412 Massachusetts Inst. of Tech., Cambridge
TACTILE COMMUNICATIONS WITH AIR JETS
Lester Saslow Mar. 30, 1962 99 p 38 refs
(NASA Grant NsG-107-61; Contract SAV 1004-61)
(Repts. 8768-1 and 8649-1) OTS: $8.60 ph, $3.17 mf

The use of air jets impinging upon the skin as a means of applying feedback or information transfer to the human is investigated. Absolute thresholds with the use of a single constant pressure jet at a distance of 1/8 inch from the finger surface are first determined. The use of a "constant pressure" jet, and pulsating jet at 1.2 cps, together with a stylus of diameter the same order of magnitude as the jet at the skin surface are then investigated. The advantages of a pulsating jet are shown. A similarity between the stimulus-response relationship of a "constant pressure" jet and a stylus when used in a continuous manner is demonstrated. Multiple air jet stimulation is also investigated with the aid of a three-by-three matrix of air jets. Information transfer rates with the use of random one, two, and three air jet simultaneous activations are obtained. Similarities are shown to exist between the errors incurred when either one, two, or three jets are activated. Correspondence between relative sensitivity, as obtained with a simple two-point determination test, and ability to correctly identify an air jet is shown. Author

N63-10415 California U., Los Angeles. Numerical Analysis Research

ESTIMATION OF VARIANCES FOR RADIO DIRECTION FINDING EQUIPMENT Technical Report

W. E. Smith Nov. 1962 12 p 3 refs
(Contract Nonr-233(76); Grant DA-ARO(D)-31-124-G77)

A problem that is important in the use of radio direction finding techniques is that of estimating the variances of the readings obtained from the different receivers. These variances are needed in order to perform a least squares estimate for the most probable point for the transmitter. In many cases, one may not know the true position of any transmitter and therefore cannot obtain an estimate of the variance of a single receiver. By taking several receivers, one can estimate a position of the transmitter, and, using the information, one should be able to make an estimate of the accuracy of the various receivers. Two approaches to this problem have been suggested by Beal [1961], one based on the work of Daniels [1951]. Professor C. B. Tompkins suggested another method which was the basis for this presentation. A specific model was described which could be simulated on a high-speed computer. The theory, computations to be performed, and results are described. The method is able to distinguish between good and poor receivers and in many cases gives excellent approximations to the variances. Author

N63-10444 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

SOME APPLICATIONS OF COMPLEMENTARY DECODING SYSTEMS WITH DIRECTIONAL ELEMENTS

J. Bromirski Sept. 13, 1962 12 p 5 refs Transl. from Archiwum Automatyki i Telemechaniki, v. 6, no. 4, 1961 p 399-408
(FTD-TT-62-1007/1+2)

The method of designing complementary decoding systems with directional elements is expanded in this work by introduction of rectifier switches into the system. Application of the system as a coder is discussed. Conceptual diagrams are given for realization by means of contactless and contact elements. Author

N63-10453 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

DESIGNING RADAR TRACKING SYSTEMS WITH RANDOM DISTURBANCES TAKEN INTO ACCOUNT

V. P. Perov Sept. 25, 1962 205 p 24 refs Transl. of "Raschet Radiolokatsionnykh Sledyashchikh Sistem s Uchetom Sluchaynykh Vozdeystviy" Leningrad, Gosudarstvennoye Soyuznoye Izdatel'stvo Sudostroitel'noy Promyshlennosti, 1961 167 p
(FTD-TT-62-623/1+2)

The monograph sets forth methods of computing the influence of various types of noise on the precision and range of radar-station tracking systems with line-scanning antenna beams and, in particular, radar stations operating in the circular-scanning mode. It presents simple methods of determining optimum structural diagrams for the tracking systems and computing the potential errors of automatic coordinate measurement. The material in the monograph may be used by engineers and scientific workers in designing radar tracking systems, as well as in investigation of the potential performance of such systems. Author

N63-10462 National Research Council of Canada. Radio and Electrical Engineering Div., Ottawa

THE PERFORMANCE OF NRC TELEMETRY COMPONENTS IN THE FIRST BLACK BRANT III DYNAMIC FIRINGS

F. V. Cairns, J. H. Craven, and J. K. Pulfer Oct. 1962 23 p 2 refs
(ERB-619)

Radio-frequency telemetry components developed by the National Research Council were used in the first four dynamic test firings of the Black Brant III rockets at Wallops Island in June 1962. Telemetered records of incident and reflected power in the antenna feed line, and ground records of signal strength and transmitter frequency were analyzed to evaluate the performance of the NRC components. No serious deficiencies were found in these components. Author

N63-10464 Rome Air Development Center. Advanced Development Lab., Griffiss AFB, N.Y.

A SATELLITE LOOK ANGLE CALCULATOR

Rodney C. Pratt Oct. 1962 21 p 2 refs
(RADC-TDR-62-391)

The satellite look angle calculator is designed to be an aid to satellite tracking and a tool for engineers working with satellite configurations. To use the calculator, the position of a satellite must be known for some particular time, and from this information the following can be obtained: (1) look angles for the satellite (azimuth and elevation) from a particular tracking station; (2) the satellite position above the earth for any time; (3) satellite period and velocity; (4) orbit traces from one revolution to the next; (5) Doppler shift information; (6) slant range from tracking station to satellite. Author

N63-10481 Aeronutronic, Newport Beach, Calif.

STUDY AND EXPERIMENTAL INVESTIGATION ON SAMPLING RATE AND ALIASING IN TIME-DIVISION TELEMETRY SYSTEMS [Final] Technical Report [Mar.-Sept. 1961]

J. W. Capps, W. F. Link, C. D. Eatough, and D. G. Childers Wright-Patterson AFB, Ohio, Electromagnetic Warfare and Communications Lab., June 1962 171 p 2 refs
(Contract AF 33(616)-8033)
(ASD-TR-61-553)

A study to determine the effect of 1) data power spectrum and 2) system design parameters on "aliasing" and data interpolation error has been conducted. Results are applicable to time-division multiplexed telemetry systems. In particular, the results apply to the commonly used PAM-FM, PDM-FM, and PCM-FM telemetry systems. Data were obtained on the basis of combined analysis and experiment with emphasis on the derivation of experimentally proven design parameters. The program consisted of three phases: 1) A survey was conducted to determine typical telemetry data spectra. 2) Analysis was performed to predict accuracy performance of practical data and interpolation filters using selected examples. Included is a more general analysis to determine optimum filter transfer functions, both realizable and nonrealizable. 3) Experimental tests using data spectral models were performed to derive proven interpolation accuracy performance on the basis of practical filters and design paramaters. The experimental tests utilized a PAM-FM system to derive an accurate measurement of attainable performance and to indicate when other equipment factors begin to impose a limit on data recovery accuracy. Author

N63-10522 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

ACADEMY OF SCIENCES OF THE USSR. LABORATORY OF INFORMATION TRANSMISSION SYSTEMS. PROBLEMS OF INFORMATION TRANSMISSION (SELECTED ARTICLES)

V. A. Makhonin, G. N. Povarov, V. M. Ostianu, and V. S. Fayn Oct. 12, 1962 60 p 34 refs Transl. from "Akademiya Nauk SSSR Laboratoriya Sistem Peredachi Informatsii Problemy Peredachi Informatsii", no. 10, 1961, p 5-23, 35-41, 42-48, and 49-56
(FTD-TT-62-888/1+2+4)

CONTENTS:

1. SOME PROBLEMS OF MULTICHANNEL COMMUNICATIONS V. A. Makhonin p 1-27 1 ref
2. THE GEOMETRY OF BOOLEAN FUNCTIONS AND SELFCORRECTING CODES FROM THE POINT OF VIEW OF THE ERLANGEN PROGRAM G. N. Povarov p 28-35 19 refs

3. THE CONSTRUCTION OF NONBINARY ERROR-CORRECTING CODES AND THE BOUND OF THE NUMBER OF SIGNALS IN THEM p 36-44 6 refs
4. IDENTIFICATION OF SPATIAL OBJECTS V. S. Fayn p 45-57 8 refs

N63-10527 Illinois U. Antenna Lab., Urbana

ON A CONICAL QUAD-SPIRAL ARRAY. AN ANTENNA TO COVER THE 220 THROUGH 2400 MC TELEMETRY BANDS

John D. Dyson Sept. 1962 13 p 10 refs Presented at the National Telemetering Conf., Wash., D. C., May 23-25, 1962

(Contracts AF 33(657)-8460 and AF 33(616)-6079)

(Tech. Rept. 63)

The shift in telemetry activity to the microwave region will require that some installations provide the capability of working on several bands in the range of frequencies from 220 through 2400 Mc. An antenna is proposed which will provide circularly polarized, moderate gain coverage throughout this range of frequencies. The conical log-spiral antennas may be designed to cover an arbitrarily wide range of frequencies and may be employed as array elements. An array of four such elements, a "conical quad-spiral array," has been constructed and tested from 400 to 4000 Mc. It may be readily scaled to cover the UHF and microwave telemetry bands. Author

N63-10559 Naval Ordnance Lab., Corona, Calif.

THE TWO-LOOP SUPERDIRECTIVE END-FIRE ANTENNA

Elwin W. Seeley Apr. 1, 1962 25 p

(NOLC-562)

An analytical study of the two-loop end-fire antenna array reveals many desirable characteristics at VLF. Curves and equations are presented to show that the directivity improves as the loop spacing becomes smaller. The front lobe narrows, the front-to-back ratios increase, and the back lobes and nulls become invariant when closely spaced loops are used. The most critical limitation of the array is the inequality of voltages of the individual loops, which tends to obscure the nulls. Author

N63-10560 Naval Ordnance Lab., Corona, Calif.

THE THREE-LOOP SUPERDIRECTIVE ANTENNA

Elwin W. Seeley May 1, 1962 24 p

(NOLC-563)

The characteristics of a three-loop superdirective antenna array are presented. At VLF, this type of array appears to have many desirable qualities, and the usual detrimental characteristics associated with superdirectivity are minute. It is shown that the beamwidth is narrowest, the front-to-back voltage and power ratios are greatest, and the position of the back lobes and nulls are most invariant when closely spaced loops are used. Inequalities in signals from the individual loops tend to obscure the nulls and limit the proximity of the loops. Author

09 ELECTRONICS

Includes: circuits and circuit theory; electronic components (e.g., tunnel diodes, transistors, and tubes); and feedback and control theory.

For related information see: 06 Auxiliary Systems; 08 Communications; 15 Instrumentation; 22 Navigation and Guidance; and 25 Physics, Solid-State.

N63-10008 Aeronautical Systems Div. Flight Control Lab., Wright-Patterson AFB, Ohio

ADAPTIVE FLIGHT CONTROL—PAST, PRESENT, AND FUTURE

Edwin B. Stear and Philip C. Gregory [1962] 35 p 43 refs Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-12. 1962

(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 10) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

A summary is presented on adaptive flight control systems research. The problems with conventional flight control systems, which prompted adaptive flight control research, are presented in historical order, with appropriate conclusions as to the relative success of the various research efforts conducted. A description of the adaptive flight control system being flown in the X-15 research vehicle, its accomplishments, and its mechanization are discussed. The limitations of adaptive control systems of the X-15 type are pointed out, and the research effort underway on second generation adaptive flight control systems is discussed. Author

N63-10080 Coordinated Science Lab., U. of Ill., Urbana

A NUMERICAL APPROXIMATION TECHNIQUE FOR FILTER FUNCTIONS

William Frederick McGee Aug. 1962 66 p 30 refs

(Contract DA-36-039-SC-85122)

(R-151)

A new method is proposed for generating amplitude-frequency filter transfer functions of the usual type. The method consists of two algorithms based on modifications of the second method of Remez. Using this method it is shown how to generate the following types of filter functions—the low-pass equiripple polynomial filter function with zeros at the origin; the low-pass equiripple filter function with a variable number of zeros in the passband and a variable number of poles in the stop-band; the asymmetrical equiripple band-pass filter function; and the double band-pass equiripple filter function. The parameters that must be specified are discussed. Modifications to the basic methods that make them more useful to the filter designer are also presented. A discussion is given of the convergence of the proposed algorithms. Examples are given. It is expected that these methods will be useful in filter design. Author

N63-10081 Coordinated Science Lab., U. of Ill., Urbana

DISTRIBUTED RC NETWORKS WITH RATIONAL TRANSFER FUNCTIONS

Kenneth W. Heizer Sept. 1962 89 p 29 refs

(Contract DA-36-039-SC-85122)

(R-153)

A distributed RC circuit analogous to a continuously tapped transmission line can be made to have a rational short-circuit transfer admittance and one rational short-circuit driving-point admittance. A subcircuit of the same structure has a rational open circuit transfer impedance and one rational open circuit driving-point impedance. Hence, rational transfer functions may be obtained while considering either generator impedance or load impedance. The functions have poles only along the negative real axis. Although the number of poles is arbitrary, only two may be chosen with complete freedom in a single unit. The residue of a pole in the short-circuit transfer admittance is related to the corresponding residue of the rational driving-point short-circuit admittance. A wide class of transfer functions may be realized by placing one distributed circuit in parallel with the output of another distributed circuit. The loss and total capacity required are often the same order of magnitude as those for lumped circuits. Complex zeroes may readily be obtained with these circuits. In many cases active elements may be used to an advantage in the same manner as with lumped RC networks. Author

N63-10137 Case Inst. of Tech., Cleveland, Ohio

SYNTHESIS OF TRANSFER FUNCTIONS USING IMMITTANCE OPERATORS

Togan Zeren May 1, 1962 58 p 14 refs

(Contract AF 19(604)-3887)

(Scientific Rept. 31; AFCRL-62-320)

This paper deals with the synthesis of transfer functions of 3T Networks using the concept of immittance operators. The operator and its properties are described as well as the even part split, Darlington's synthesis, and Lewis Method to obtain a polynomial with positive coefficients. These ideas are applied to synthesize a given driving point admittance with specified transfer function zeros. The variation of even part split, methods to determine the scaling constants, and the complementary networks are described. These methods are used to synthesize transfer functions with arbitrary driving point admittances. Author

N63-10145 General Telephone and Electronics Labs., Inc. Bayside, N. Y.

STUDIES OF ELECTRON TUBE MATERIALS AND THERMIONIC EMISSION PROCESSES Scientific Report No. 10, July 1, 1962-Sept. 30, 1962

John V. Florio and T. G. Polanyi [1962] 21 p 2 refs
(Contract AF 19(604)-7286)
(AFCRL-62-905; TR-62-704-104-204-208.21)

A comparison of the emission properties of pure-nickel-base cathodes under controlled test conditions, with cathodes containing known impurities in either the base metal or the coating, has permitted a more critical evaluation of the effects of the impurities on emission. The use of a binder in the carbonate coating will result in an initially active cathode, but continued operation shows a substantial decrease in emission as a result of the rapid depletion of carbon residue. The slow activation of the tungsten-nickel base oxide cathodes and the enhancement of emission with successive high-temperature processing treatments (increased reaction between tungsten and the oxide) are in sharp contrast to results obtained with the binder. Author

N63-10182 National Aeronautics and Space Administration, Washington, D.C.

MODES OF CONTROL

C. A. Harvey (Minneapolis-Honeywell Regulator Co.) Nov. 1962 15 p 1 ref Previously processed as preprint; for abstract see N62-14861 13-19
(NASA TN D-1589) OTS: $0.50

A linear autonomous system with a single control variable is considered. There are, in general, several modes of control for such a system. The concepts of single component regulation and multiple component regulation are defined. The relation between these modes of control is developed and an example is given to illustrate this relation. Author

N63-10217 Army Missile Command, Redstone Arsenal, Ala.

ADVANCED ELECTRONIC PACKAGING TECHNIQUES

Kenneth W. Plunkett Sept. 25, 1962 44 p 114 refs
(AMC-RG-TR-62-4)

This report summarizes the work accomplished under the supporting research task entitled "Advanced Electronic Packaging Techniques," from January '62 to July '62. The major advance packaging techniques—thin films, functional electronic blocks, dot components, and micromodules—are briefly identified and some problem areas pointed out. Author

N63-10301 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

THE CALCULATION OF THE SIMPLEST OPTIMUM RELAY SYSTEMS OF THE SECOND ORDER

A. A. Pavlov and V. P. Poputsillo Sept. 20, 1962 31 p 23 refs Transl. from Automatic Control and Computer Techniques (Moscow), Pt. 3, 1960 p 419-444
(FTD-TT-62-877/1+2+4)

A method is presented for calculating a class of optimum relay systems of the second order in the presence of command inputs and disturbances. Expressions are obtained for the optimum control law of each system, as well as formulas for determining the optimum control time and the maximum dynamic deviation. Using these formulas, the parameters of an automatic control system can be choosen on the basis of the requirements that the quality of the transient process must satisfy. These formulas permit the estimation of the extent the processes in a nonoptimum automatic control system of similar structure differ from optimum transient processes. J.R.C.

N63-10305 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

THE ENERGY METHOD OF INVESTIGATING THE STABILITY AND SELFOSCILLATIONS OF CONTROLLED SYSTEMS

I. F. Kavinov Oct. 10, 1962 25 p 6 refs Transl. from Nekotoryye Vopr. Analiza i Sistem Avtomaticheskogo Regulirovaniya, Sbornik Statey, (Moscow) p 52-69
(FTD-TT-61-465/1+2+4)

The energy of self-oscillations is used to determine the stability of the equilibrium position and of the self-oscillation parameters of a single-degree object of control. It is demonstrated that the conditions of asymptotic stability of a single-degree object of control is reduced to the existence, with respect to the coordinate and speed of the object, of a positive-definite energy function and the negativity of the controlling organ in steady-state oscillations for a certain frequency range. The negativity conditions of the work of the controlling organ, as is shown in this paper, depend only on the parameters of the control system, and consequently, it is convenient to use them to determine the values of the parameters themselves. The self-oscillation parameters are determined from the condition that the dissipated energy of the object vanishes. The change in the sign of the total dissipated energy determines the nature of the self-oscillations, i.e., the stable or unstable self-oscillations under consideration. J.R.C.

N63-10321 Weapons Research Establishment (Australia)

AN AUTOMATIC FREQUENCY CONTROL FOR A BEACON RADAR RECEIVER

W. V. Slee Apr. 1962 21 p
(Technical Note WPD 6)

An automatic frequency control system was designed for a C-band radar receiver used to receive signals from a missile-borne beacon. The design considerations are outlined and a detailed description of a prototype unit is given. Author

N63-10338 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

A METHOD FOR CONSTRUCTING AN AUTOMATIC CONTROL SYSTEM WHOSE TRANSIENT IS CLOSE TO OPTIMAL

A. V. Rozanov and V. I. Kukhtenko Sept. 25, 1962 11 p 1 ref Transl. from Samoletnoe Elektrooborudovanie, Sb. Statei (Oborongiz), 1960 p 63-69
(FTD-TT-62-973/1+2+4)

A method is proposed for constructing an automatic control system which can be described by a second-order differential equation and in which an optimal transient response is achieved. The method can also be used to obtain a process which is close to optimal in a system of higher order. The system consists of a mismatch meter MM, an amplifier, a generator-motor supply circuit, an RC feedback circuit, and a correcting relay circuit. At small deviations of the controlling signal, regulation is carried out through that channel which consists of a mismatch meter, an amplifier, generator-motor system, and a feedback circuit. J.R.C.

N63-10355 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

TWO-PARAMETER CONTROL

Stefan Wegrzyn Sept. 21, 1962 14 p 2 refs Transl. from Pomiary Automatyka Controla (Poland), no. 1, 1961 p 5-7
(FTD-TT-62-784/1+2)

This article discusses such fundamental problems for the two-parameter control as finding the static operation point and calculating the stability conditions. Author

N63-10416 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

A METHOD FOR DETERMINING THE CHARACTERISTIC IMPEDANCES AND DEGREE OF MISMATCH OF TWO-TERMINAL PAIR NETWORKS

L. N. Dmitriyeva Oct. 11, 1962 5 p Transl. of Soviet Patent No. 132716 (652042/26), Jan. 25, 1960
(FTD-TT-62-481/1+2+4)

A method is presented for determining the characteristic impedances and degree of mismatch of two terminal pair of networks. The error in determining the characteristic impedance by the method described, when instrument sensitivity (with respect to phase) is on the order of 6-in., is $\pm 0.1\%$. The degree of mismatch is determined by the difference between phase shifts obtained when connecting the examined two terminal pair network and its load in parallel with the load of the cathode follower, and the characteristic impedance is determined by the load impedance of the two terminal pair network at which there is no difference between phase shifts. J.R.C.

N63-10429 General Electric Co. Power Tube Dept., Schenectady, N.Y.

INVESTIGATION OF VARIOUS ACTIVATOR REFRACTORY SUBSTRATE COMBINATIONS Scientific Report No. 2

J. H. Affleck June 27, 1962 23 p 10 refs
(Contract AF 19(628)-279)
(AFCRL-62-513)

Life tests, work function, and evaporation rate measurements are discussed. The barium orthosilicate cathode is nearing 6000 hours at 1 a/cm^2. The work function of tantalum silicide has been measured and is very close to the value for Ta, $\phi = 4.06 + 2 \times 10^{-4}$ T ev. The partial pressure analyzer is being installed for future environmental studies. An analysis is made of the requirements and the limitations of high-current density emitters. Author

N63-10437 General Electric Co. Power Tube Dept., Schenectady, N.Y.

INVESTIGATION OF VARIOUS ACTIVATOR-REFRACTORY SUBSTRATE COMBINATIONS

J. H. Affleck Feb. 26, 1962 10 p 14 refs
(Contract AF 19(604)-4093)
(Scientific Rept. 15; AFCRL-62-110)

The effective work function of a dispenser cathode has been measured at an operating temperature using a close-spaced diode. Life tests, instantaneous evaporation rates, and pulsed emission measurements are being made on a tungsten-barium orthosilicate dispenser cathode. A summary of the pertinent results of this investigation is given along with speculations on the emission mechanism. Author

N63-10475 Lincoln Lab., Mass. Inst. of Tech., Lexington

THE DESIGN OF SEMICONDUCTOR-DIODE DETECTOR CIRCUITS

G. R. Curry and M. Axelbank Feb. 28, 1962 171 p 37 refs
(Contract AF 19(604)-7400; ARPA Order 178)
(Rept. 47G-3)

A theoretical and experimental investigation has been made of the design of detector circuits using semiconductor diodes. The detector circuits are intended for use with transistor circuits having impedance levels of a few thousand ohms and current levels of a few milliamperes at frequencies up to 100 Mcps. High-impedance detectors useful for measuring the level of a CW signal, and pulse detectors having rise-times of the order of 0.1 μsec are considered. A detector-design procedure, based on semiconductor theory, is presented that permits the calculation of detector-circuit performance on the basis of measurements of the parameters of the diode to be used. The effects of frequency, diode paramaters, detector load and driving circuits, temperature, and output coupling are considered. Measurements are reported that show good agreement with calculated detector-circuit performance over moderate ranges of the parameters for high-impedance and pulse detectors using germanium and silicon diodes. Sample designs of both high-impedance and pulse detectors are carried out, and measurements on sample detectors are reported. Measurements for evaluating the performance of several diode types in high-impedance and pulse detector circuits are presented. Author

N63-10574 Gt. Brit. Ministry of Aviation. Technical Information and Library Services, Mottingham

THE 2C39A DISC TRIODE, ITS MANUFACTURE AND APPLICATIONS (DIE SCHEIBENTRIODE 2C39A IHRE HERSTELLUNG UND ADWENDUNG)

H. Blume and J. Kellerer Oct. 1962 14 p Transl. from Siemens Zeitschr., 1958, 32(1), 17-25
(TIL/T-5319)

The 2C39A is an air-cooled transmitting triode with a maximum anode dissipation of 100 W for coaxial oscillating circuits. Its applications extend to 3000 Mc/s. Development problems, construction, and performance characteristics are described. Author

10 FACILITIES

Includes: airports; lunar and planetary bases; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands and wind tunnels); test ranges; and tracking stations.

For related information see: 06 Auxiliary Systems.

N63-10074 California U., Livermore. Lawrence Radiation Lab.

PLUTO REACTOR TEST FACILITY—SITE 401. PART 8 OF THE TORY II-C PROGRAM

William C. Miller Sept. 5, 1962 34 p 7 refs
(Contract W-7405-eng-48)
(UCRL-7036, Pt. 8) Available from AEC Div. of Tech. Information Ext., P. O. Box 1001, Oak Ridge, Tenn.: $0.75

The description of the Pluto Test Facility is divided into three parts: (1) site description, (2) test air system, and (3) air system operations. The first briefly describes the functional areas, building layout, and associated activities. The second describes the air system and its performance requirements. The third part is a chronological sequence of events that are performed when a reactor is to be tested. J.R.C.

N63-10148 Chicago U., Ill.

CHARACTERIZATION AND EXTENSION OF SIMULATION CAPABILITIES OF THE LAS HIGH TEMPERATURE ARC FACILITY [Final Report, Mar. 16, 1961-Mar. 15, 1962]

Henry Halle and Channon F. Price Wright-Patterson AFB, Ohio, Directorate of Materials and Processes, Aug. 1962 80 p 8 refs
(Contract AF 33(616)-8115)
(ASD-TDR-62-461)

The operation of an existing subatmospheric plasma arc facility was characterized to assist the user in selecting the proper simulation conditions for materials test application. To this end, eight principal test conditions were established within the operating limits of the arc, and the pertinent parameters describing the thermal environment were determined and tabulated. Subsequently, the hypersonic reentry conditions corresponding to the thermal environment of the test conditions were computed and plotted on a velocity-altitude chart. In addition, an arc unit with water-cooled, nonconsumable

electrodes was developed to reduce contamination of the arc plasma. This arc, having double-ring electrode configuration, will generate plasma with a net average enthalpy of 8000 Btu/lb. The final phase concerned testing various materials under different exposure conditions. Author

N63-10240 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

NASA WORLDWIDE TRACKING SYSTEMS

Hartley A. Soulé *In* Virginia Polytechnic Inst., Blacksburg. Reentry Dynamics, Part II. Proc. of the Conf. on Physics of the Solar System and Reentry Dynamics, July 31 to Aug. 11, 1961 p 276-300 2 refs (See N63-10230 01-01) VPI: $2.00

The paper is divided into four parts. The first part deals with the factors which influenced the type, size, and the amount of equipment selected for the different NASA tracking and data-acquisition networks; the second part describes the NASA Deep Space Instrumentation Facility; the third part the Minitrack Network, which was developed for unmanned-earth-satellite programs; and the fourth part the Mercury Man-in-space tracking and ground-instrumentation system. Author

N63-10241 General Electric Co. Missile and Space Vehicle Dept., Philadelphia, Pa.

LABORATORY IN SPACE

Irving Gruntfest *In* Virginia Polytechnic Inst., Blacksburg. Reentry Dynamics, Part II. Proc. of the Conf. on Physics of the Solar System and Reentry Dynamics, July 31 to Aug. 11, 1961 p 301-313 12 refs (See N63-10230 01-01) VPI: $2.00

Using the Thor and Atlas nose cone as a space laboratory, studies of the following can be made: meteorology, space environment, physiology, hypersonic aerodynamics, communications, materials and structures, and hardware development. These studies are described. J.R.C.

N63-10242 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

GROUND FACILITIES FOR TESTING REENTRY STRUCTURES AND MATERIALS

R. R. Heldenfels *In* Virginia Polytechnic Inst., Blacksburg. Reentry Dynamics, Part II. Proc. of the Conf. on Physics of the Solar System and Reentry Dynamics, July 31 to Aug. 11, 1961 p 314-338 18 refs (See N63-10230 01-01) VPI: $2.00

Successful development of reentry vehicles is vitally dependent upon materials and structures that have been thoroughly tested in ground facilities which simulate or reproduce the important characteristics of the reentry environment. Various approaches for providing the required test conditions in the laboratory are considered, with emphasis on the facility design approaches used at the NASA Langley Research Center. Problems encountered in the design of these facilities are discussed, and facility utilization is illustrated by brief descriptions of typical research projects. Author

N63-10409 Ohio State U. Aerodynamic Lab., Columbus

INITIAL CALIBRATIONS AND PERFORMANCE OF THE ARL TWENTY-INCH HYPERSONIC WIND TUNNEL [Interim Technical Report, Jan. 1960-April 1962]

G. M. Gregorek Wright-Patterson AFB, Ohio, Aeronautical Research Labs., Aug. 1962 35 p 6 refs
(Contract AF 33(616)-7451)
(ARL-62-393)

The results obtained and the observations made from the initial operation of the Aeronautical Research Laboratories Hypersonic Wind Tunnel are treated. Mach number calibrations of two nozzle throats (nominal Mach 12 and Mach 14), performance tests of the diffuser and heat exchanger, and operational checks of the high pressure air station and of the vacuum system have been made and the results presented. Included are measurements of the boundary layer growth, effects of air liquefaction, and characteristics of overexpansion in the axisymmetric contoured nozzle used for the test series. Author

N63-10535 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

PRELIMINARY EVALUATION OF TWO JET-TRANSPORT SIMULATORS FOR THE INVESTIGATION OF LANDING-CONTACT CONDITIONS

Harold L. Crane Washington, NASA, Nov. 1962 21 p 3 refs
(NASA TN D-1495) OTS: $0.50

In order to determine whether jet-transport flight simulators would be suitable for research on factors which affect airplane landing-contact conditions, about 50 landings were recorded on each of two existing simulators of different manufacture. It was found that the vertical velocities at landing were much greater for the simulators than for the actual airplanes and, therefore, that these simulators, without further refinement, would not be suitable for this research application. Author

11 FLUID MECHANICS

Includes: boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence.

For related information see: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings and Control Surfaces; 13 Heat Transfer; and 24 Physics, Plasma.

N63-10014 Bölkow Entwicklungen K. G., Munich (W. Germany)

GEMEINSAME GRENZSCHICHTABSAUGUNG FÜR HOCHAUFTRIEB UND SCHNELLFLUG [COMMON BOUNDARY LAYER SUCTION FOR HIGH LIFT ANF FAST FLIGHT]

[R.] Eppler Oct. 2, 1962 34 p 14 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-12, 1962
(FM-158; Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 16) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

Continuous boundary suction has been instituted with success in the conquest of the obstacle of laminar-turbulent-boundary changes and also in the avoidance of separation. Both cases require, however, particularly when they are applied to so-called "conventional" profiles, basically different suction distributions. While in high lift it is essential that suction be provided in the vicinity of the leading edge, while in rapid flight demands suction at the after portion of the profile, where the principal pressure rise occurs. In the computation of wing profiles with advance estimation of pressure distribution, one may devote enough attention to the dual purpose boundary suction so that the same suction device will serve to obtain effective results in the case of high lift as well as in rapid flight. Examples of wing profiles and their associated suction arrangements are reported upon in this paper. A.S.

N63-10015 Technische Hochschule Carolo Wilhelmina. Inst. für Strömungsmechanik, Brunswick (W. Germany)

EIN NÄHERUNGSVERFAHREN ZUR BERECHNUNG DER KOMPRESSIBLEN LAMINAREN GRENZSCHICHT MIT KONTINUIERLICH VERTEILTER ABSAUGUNG [AN APPROXIMATION METHOD FOR COMPUTATION OF THE COMPRESSIBLE LAMINAR BOUNDARY LAYER UNDER CONTINUOUSLY DISTRIBUTED SUCTION]

W. Pechau [1962] 29 p 20 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-11, 1962

(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 17; Rept. 62-32) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

An approximation method is developed for the computation of the compressible laminar boundary under suction and with heat-impermeable walls at a Prandtl number of one. In the case of incompressible flow, this approximation method goes beyond the results determined in an earlier study by H. Schlichtung. Also, from this determinative method, a simplification has been derived which surpasses that given in a paper by E. Truckenbrodt. In comparison with known, exact solutions, good agreement is demonstrated. Further, systematic boundary computations for wing profiles in the subsonic and supersonic domains can be carried out; and the influence of various suction distributions upon the formation of the boundary layer and on the position of the separation point can be studied. Trans. by A.S.

N63-10026 Focke-Wulf, Bremen (W. Germany)
UNTERSUCHUNGEN ÜBER DIE VON HUBSTRAHLEN AN SENKRECHTSTARTERN ERZEUGTEN SEKUNDÄRKRÄFTE [STUDIES OF THE SECONDARY POWER GENERATED BY VERTICAL LIFT JET STREAMS]
Wilhelm Seibold Sept. 5, 1962 34 p 9 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-11, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 28) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

In this paper, measurements of secondary forces appearing in a vertical takeoff are set forth. Only one engine was provided in a somewhat neutral wing position so that strong secondary forces were produced. By propitious arrangement of several nozzles, preferably close to the contour of the aircraft, a positive upward thrust in the vicinity of the ground is obtained. More important than the secondary lifting forces are the generally destabilizing rolling moments, which are important in hovering control. These moments should be measured and given consideration in the design of any vertical start aircraft. A.S.

N63-10064 Technische U. Berlin. Hermann-Föttinger-Institut für Strömungstechnik (W. Germany)
SUR MESSUNG DER TURBULENTEN WANDREIBUNG MIT DEM PRESTON ROHR [ON THE MEASUREMENT OF TURBULENT SKIN-FRICTION WITH THE PRESTON TUBE]
Ingo Rechenberg [1962] 15 p 11 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-12, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 71) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

A method for measuring friction layers of the lowest values of skin friction by an extension of the Preston Tube Method is presented. In addition, several research papers in current literature dealing with wall-proximal velocity distributions in the supersonic and hypersonic boundaries are critically analyzed. The application of the Preston tubes for the measurement of skin friction stress in these flow domains is discussed. A.S.

N63-10089 Boeing Scientific Research Labs., Seattle, Wash.
EFFECT OF SLIP ON THE LAMINAR BOUNDARY LAYER NEAR THE LEADING EDGE OF A FLAT PLATE IN HYPERSONIC RAREFIED GAS FLOW
Robert E. Street Sept. 1962 10 p
(Flight Sciences Lab. Tech. Memo-8; Addendum to Boeing Document D1-82-0138; Flight Sciences Lab. Rept. 49)

The additional terms in the skin friction and heat transfer equation for determination of the effect of slip on the laminar boundary layer near the leading edge of a flat plate in hypersonic rarefied gas flow are derived, and a discussion is presented on the revised conclusions necessary to correct present theory. The resulting series for skin friction and heat transfer coefficients definitely show signs of divergence. It is seen that the basic assumption of wedge-like flow with constant properties at the outer edge of the viscous layer now appears to be incorrect and the other assumption, that the boundary layer equations are valid, may also be in error. J.R.C.

N63-10095 Space Technology Labs., Inc., Redondo Beach, Calif.
THE FLOW OF A DISSOCIATING GAS AROUND AND BEHIND A BLUNT HYPERSONIC BODY
Andrew G. Hammitt May 25, 1962 25 p 2 refs
(Contract AF 04(694)-1)
(Rept. 6130-6187-KU000; BSD-TDR-62-107)

A study of dissociation reaction of a diatomic gas has been performed for the pressure history, a pressure rise and subsequent decay, common to hypersonic flow about a body. For this simplified case, several interesting phenomena which occur have been explored. A characteristic reaction time has been identified; the areas in which dissociation or recombination is the faster reaction have been specified; the areas in which equilibrium is entropic expansion leads to dissociation or recombination are found; the relative importance of the irreversibility associated with nonequilibrium relaxation has been defined. Author

N63-10138 Aeronautical Research Council (Gt. Brit.)
ON THE CONTROL OF SHOCK-INDUCED BOUNDARY-LAYER SEPARATION WITH DISCRETE AIR JETS
R. A. Wallis (Dept. of Supply, Australia) and C. M. Stuart (Natl. Phys. Lab.) London, HMSO, 1962 51 p 7 refs
(ARC-CP-595; previously issued as ARC-19865) Available from HMSO: 7s. 6d.

High-speed tunnel experiments with discrete air jets possessing a spanwise ejection velocity component have shown that such jets produce a strong persistent vorticity similar to that associated with vane-type vortex generators. The use of small quantities of air facilitated the reattachment of the separated layer downstream of the shock wave, while moderate quantities almost completely suppressed the separation. This work, which was of a preliminary nature, was carried out on a half-aerofoil fitted to the wall of the N.P.L. 9 in. x 3 in. high-speed wind tunnel. Author

N63-10155 Grumman Aircraft Engineering Corp., Bethpage, N. Y.
HYDROELASTIC EFFECTS ON THE LIFT OF HIGH SPEED HYDROFOILS Final Report
J. Dulmovits May 1, 1962 56 p 6 refs
(Contract NObs-84570)
(STR-MAR-100)

A method is presented by which the effects of elasticity (twist and change in chordwise shape) on the lift of a flexible supercavitating hydrofoil with known elastic properties may be calculated. This method is then used to calculate the lift on four hydrofoils, and a comparison is made with the lift measured in the Grumman Whirl Tank. Author

N63-10167 California U., Berkeley. Inst. of Engineering Research
ON THE NORMAL MODES OF NONLINEAR COUPLED SHIP MOTIONS AND THEIR STABILITY
W. D. Kinney Aug. 1962 33 p 6 refs
(Contract Nonr-222(75))
(IER Ser. 173, Issue 5)

The concept of normal oscillations of a nonlinear conservative system is introduced and applied to the ship-motion problem. In addition, the stability of these normal modes is investigated. Since the system is assumed to be conservative, all displacements are necessarily finite. Author

N63-10206 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

PRESSURE DISTRIBUTION INDUCED ON A FLAT PLATE AT A FREE-STREAM MACH NUMBER OF 1.39 BY ROCKETS EXHAUSTING UPSTREAM AND DOWNSTREAM

Abraham Leiss Washington, NASA, Nov. 1962 55 p 6 refs
(NASA TN D-1507; supersedes NASA TM X-129) OTS: $1.50

Results are presented of jet effects obtained on a flat plate located adjacent to a rocket jet exhausting at a Mach number of 3, both downstream and upstream into a free-stream flow at a Mach number of 1.39. Pressure measurements on the flat plate were tabulated for 11 test positions and rocket-exit total-pressure ratios from 6 to 60. Author

N63-10215 Hydronautics, Inc., Rockville, Md.

ANALYSIS OF THE BULBOUS BOW ON SIMPLE SHIPS

B. Yim Aug. 1962 62 p 21 refs
(Contract Nonr-3349(00))
(Tech. Rept. 117-1)

A procedure has been developed for the analysis of the bulbous bow on simple ships. The procedure permits analyzing not only the wave resistance but also the effect of the size and location of the bulb. Also, the fundamental relationship between the source and doublet under the free surface can be investigated. The effect of linearizing the boundary condition on the ship's surface does not have to be considered. First, the simplest system, a point doublet and a point source, is treated. Second, a system consisting of point doublet and a finite source line is considered. Third, a system consisting of a vertical doublet line under the free surface and a vertical source line from the free surface is treated. To obtain the wave resistance, Lagally's theorem is used in the first case while Havelock's formula is used in the second and third cases. The actual shapes of the low resistance systems are found by computing the actual stream lines. The bulb is found to be very large so that the bulb itself may be considered to be a bow rather than an appendage. B.J.C.

N63-10216 Hydronautics, Inc., Rockville, Md.

ON SHIPS WITH ZERO WAVE RESISTANCE

B. Yim Aug. 1962 34 p 9 refs
(Contract Nonr-3349(00))
(Tech. Rept. 117-2)

The effect of a bulb on a ship is investigated by considering interactions between the waves themselves. A doublet distribution was found that extends along a line from the free surface to infinite depth. The effect of discarding that part of the doublet distribution extending from some finite depth to infinity can be made very small. With such a doublet distribution at the bow and stern the waves from the bow and stern of the given symmetric ship may be completely cancelled and the ideal fluid wave resistance of the ship becomes zero. B.J.C.

N63-10218 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

AN APPROXIMATE FORM FOR THE FREE-SURFACE SHAPE OF A STATIC FLUID IN A CYLINDRICAL TANK OF LARGE RADIUS

H. E. Williams Sept. 28, 1962 10 p
(NASA Contract NAS7-100)
(JPL-TR-32-344) OTS: $1.10 ph, $0.80 mf

A correction for the effect of curvature of a cylindrical wall of radius a is presented which can be applied to the free-surface shape of a static fluid near a planar wall acted upon both by gravity and surface tension. This correction is applicable when the ratio of the characteristic length of the fluid ($\lambda = \sqrt{\sigma/\rho g}$) to the radius of the wall is a small number. Author

N63-10236 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

REAL GAS FLOW CONDITIONS ABOUT HYPERSONIC VEHICLES

Macon C. Ellis, Jr., and Paul W. Huber *In* Virginia Polytechnic Inst., Blacksburg. Reentry Dynamics. Part II. Proc. of the Conf. on Physics of the Solar System and Reentry Dynamics, July 31 to Aug. 11, 1961 p 120-154 102 refs (See N63-10230 01-01) VPI: $2.00

Some significant points arising from real-gas effects on the flow about reentry vehicles are reviewed. The areas covered include the thermodynamic state of air at a stagnation point for several example reentry flight paths, stagnation point heat transfer, flow fields about a simple body, and plasma conditions about a vehicle as affecting radio transmission to and from the vehicle. J.R.C.

N63-10307 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

THE FLOW OF A SUPERSONIC IDEAL GAS PAST A FLAT PLATE IN THE PRESENCE OF VOLUME HEAT RELEASE

I. F. Shanknov and V. A. Frost Sept. 19, 1962 19 p 7 refs Transl. from Tr. Mosk. Fiz.-Tekhn. Inst. No. 7, Issled. po Mekhanike i Prikladnoy Mat., 1961 p 110-123
(FTD-TT-62-1049/1+2+4)

The classical method of characteristics and the method of linearization of equations are altered in order to calculate the supersonic flow of an ideal gas in the presence of volume heat transfer. A comparison is presented of the results of calculation by both methods for the case of flow past a flat wall when the heat is supplied to the stream in a rectangular zone. Author

N63-10336 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio

CAVITATION AND NONCAVITATION PERFORMANCE OF AN 80.6° FLAT-PLATE HELICAL INDUCER AT THREE ROTATIONAL SPEEDS

Donald M. Sandercock, Richard F. Soltis, and Douglas A. Anderson Washington, NASA, Nov. 1962 82 p 14 refs
(NASA TN D-1439) OTS: $2.25

A flat-plate helical inducer with a tip helix angle of 80.6° was operated at three rotor speeds in water in order to obtain the performance of this type of inducer and to observe any scale effects associated with a change in speed. The test rotor had three blades, a tip diameter of 5 inches, and a hub-tip radius ratio of 0.5. Both hub and tip radii were held constant across the rotor. Similar inlet flow conditions were maintained at the three different speeds by operating at constant values of normalized net positive suction head. The performance results are presented as overall performance and as radial distributions of both flow conditions (at rotor inlet and outlet) and selected blade-element performance parameters. In addition to indicating performance levels, the radial distributions describe the type of flow patterns occurring across the rotor and show the radial variations of flow conditions a succeeding blade row, or pump, would have to accept over a range of operating conditions. Author

N63-10345 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

EXPERIMENTAL INVESTIGATION OF THE FLOW OF A VAPORIZED LIQUID FILM ALONG THE SURFACE OF A CONE FLOWN BY GAS

V. N. Polyayev Sept. 19, 1962 16 p 2 refs Transl. from Izv. Vysshikh Uchebn. Zavedenii, Mashinostro. (Moscow), no. 5, 1960 p 140-148
(FTD-TT-62-1031/1+2+4)

A method is examined for protecting a hot wall by creating a liquid film on its surface. Results are cited of an experiment concerning the flow of a liquid film along a smooth surface of a cone past which flows a high temperature gas, and recommendations will be given for an undetached flow of a liquid (water) along the cone surface. A formula is obtained for determining the initial flow velocity of a liquid film (water) relative to the velocity of the free-stream flow. Author

N63-10357 Union Carbide Nuclear Co. Flow Research Lab., Oak Ridge, Tenn.

A GENERALIZED CRITERION FOR THE LAMINAR-TURBULENT TRANSITION IN THE FLOW OF FLUIDS

Richard W. Hanks Nov. 19, 1962 136 p 47 refs
(Contract W-7405-eng-26)
(K-1531) OTS: $2.50

A brief review and discussion are given of earlier attempts to formulate a stability criterion which is more general than the simple Newtonian Reynolds number. A new parameter is formulated and its general properties are discussed. The new parameter is applied to several different situations and is shown to be applicable in general to rectilinear flow systems. The applications which are compared with experimental data include isothermal flow of Newtonian fluids in pipes, in concentric annuli, and between parallel plates; isothermal and nonisothermal flow of pseudoplastic non-Newtonian fluids in pipes; and isothermal flow of semifluids (substances possessing finite yield stresses) in pipes. Author

N63-10454 Technical Research Group, Syosset, N.Y.

LINEARIZED THEORY OF THE UNSTEADY MOTION OF A PARTIALLY CAVITATED HYDROFOIL

Herbert Steinberg Mar. 1962 106 p 3 refs
(Contract Nonr-3434(00))
(TRG-153-SR-1)

A linearized theory for the unsteady motion of a partially cavitated flat hydrofoil in two dimensions is carried out. A second linearization procedure is used, based on ideas of Timman and Guerst, to obtain the unsteady pressure distribution around the hydrofoil, and the resulting force and moment, as functions of the cavitation number and Strouhal number, for given pitch and/or heave. Author

N63-10485 Rice U., Houston, Tex.

A MODIFICATION OF THE BUSEMANN ELLIPSE FOR A REACTING GAS

Alan J. Chapman, Herbert Beckman, and J. R. Baker Repr. from J. Aerospace Sci., v. 29, no. 8, Aug. 1962 1 p 2 refs
(NASA Grant NsG-3-59)

A technique is presented which enables the treatment of a reacting gas mixture by a single parameter family of curves. The method, a modification of the Busemann Ellipse for a reacting gas, uses a single parameter family of c vs $\sqrt{2h + c^2}$ curves plotted on a transparent triangle while the specific energy of the flow is denoted by a circle in the hodograph plane—the radius being v_{max}. The method has been used to determine the characteristics of two-dimensional supersonic nozzles for the isentropic flow of a partly ionized gas in thermal equilibrium. J.R.C.

N63-10530 Michigan U. Heat Transfer and Fluid Mechanics Lab., Ann Arbor, Michigan U.

OBSERVATIONS OF CAVITATION SCALE AND THERMODYNAMIC EFFECTS IN STATIONARY AND ROTATING COMPONENTS WITH WATER AND MERCURY Technical Report No. 6

F. G. Hammitt, R. D. Ivany, V. F. Cramer, and M. J. Robinson Sept. 1962 54 p 22 refs
(NASA Grant NsG-39-60)
(Rept. 03424-6-T) OTS: $5.60 ph, $1.82 mf

Scale effects have been observed in a cavitating venturi and in a cavitating centrifugal pump with the fluids water and mercury. The cavitation number in both components correlates roughly with the Reynolds number for each fluid, and for each cavitation condition in the venturi. The loss coefficient in the venturi correlates roughly with Reynolds number for cold water and mercury on a single curve at each cavitation condition. A correlation is also found for hot water, although there is now a distinction according to venturi size. A thermodynamic effect exists in both the venturi and the pump, in the direction expected, as verified by the comparison of results from cold and hot water tests. Author

N63-10564 Aerospace Corp. Aerodynamics and Propulsion Research Lab., El Segundo, Calif.

DISSOCIATED LAMINAR BOUNDARY LAYER FLOWS OVER SURFACES WITH ARBITRARY CONTINUOUS DISTRIBUTIONS OF CATALYCITY

G. R. Inger Nov. 20, 1962 46 p 20 refs
(ATN-63(9206)-2)

This paper studies several new types of exact series solutions to the diffusion equation for chemically frozen, dissociated, laminar boundary-layer flows around bodies with arbitrary continuous distributions of a first-order atom recombination rate along the surface. Plate, wedge, and cone flows are considered. The analysis extends the theory of Chambré and Acrivos for constant surface catalytic efficiency and temperature to the case wherein the surface Dahmkohler number varies as any power of the distance, or is distributed as any polynomial involving integer or fractional positive powers of the distance. Furthermore, by imposing the approximation of local similarity in the velocity profile, the resulting solutions are also applied with good accuracy to highly cooled blunt-nosed bodies in hypersonic flow. An approximate method of solution is also developed which provides an extremely simple closed-form representation of the exact series solutions throughout the entire flow field by means of a local nonlinear extrapolation of the leading term in the series. It is suggested by several examples that this technique yields very accurate results for surface atom concentration, diffusion flux, and heat transfer distributions for a variety of streamwise variations in the wall catalycity. Author

N63-10566 Utah U., Salt Lake City

TAYLOR EXPANSIONS OF THE HYDRODYNAMIC EQUATIONS - PART II Technical Report

Keith L. McDonald Oct. 16, 1962 92 p 2 refs

The present work is a theoretical investigation of classical hydrodynamics and of electrodynamics (for the most part) of stationary media. The context treats primarily the Taylor expansions of the relevant differential equations. The topology of vector fields is emphasized and further properties of vector singular points and nodal points are established. The classical equations of motion are written in the case of arbitrarily accelerated reference frames, and the covariance of the geometrical forces is demonstrated. The translational thermal-energy equation is added to the defining differential equations. Author

12 GEOPHYSICS

Includes: auroral phenomena; upper atmospheric studies; cartography; geodesy; and geomagnetism.

For Van Allen belts see: 28 Space Radiation.

For related information see: 05 Astronomy and Astrophysics; 21 Meteorology; and 29 Space Sciences.

N63-10002 Max-Planck-Institut für Aeronomie, Lindau über Northeim (W. Germany)

DIE HOHE ATMOSPHÄRE ALS GRENZSCHICHT ZWISCHEN ERDE UND INTERPLANETARISCHEM RAUM [THE UPPER ATMOSPHERE AS BOUNDARY LAYER BETWEEN EARTH AND INTERPLANETARY SPACE]

Walter Dieminger [1962] 24 p 11 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-11, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 2) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

This survey demonstrates that in the upper atmosphere and in the neighboring interplanetary space, conditions prevail that depart considerably from those expected to be derived from extrapolations based on the lowest ten kilometers. Trans. by A.S.

N63-10069 General Dynamics/Astronautics, San Diego, Calif.
INFRARED HORIZON MEASUREMENTS FROM NEAR-ORBITING ALTITUDES Scientific Report No. 2
Romuald Anthony and Vern N. Smiley Aug. 15, 1962 26 p 2 refs
(Contract AF-19(604)-7417)
(AE62-0794; AFCRL-62-1001)

The infrared horizon was scanned from an Atlas missile during a portion of the trajectory up to 800,000 feet altitude. Data was collected with a ¼ degree field resolution in 3.5, 4.3, 4.7, and 6.3 micron spectral regions to determine radiance gradients. The window regions of the spectrum appear full of gradients which can interfere with the definition of an infrared horizon. Both the water vapor band (6.3 microns) and the carbon dioxide band (4.3 microns) have broader gradients than the atmospheric windows. Of these, the carbon dioxide band may prove most useful, as it appears to also have a smoother gradient. Author

N63-10134 Ghana U., Legon
THE ELONGATION OF IRREGULARITIES IN THE EQUATORIAL IONOSPHERE Technical Note No. 3
B. R. Clemesha July 20, 1962 12 p 6 refs Project title: Equatorial Study of Irregularities in the Ionosphere
(Contract AF 61(052)-421)
(AFCRL-62-902)

Results are given of a correlation analysis of spaced aerial fading measurements for medium-frequency radio waves scattered from the D and E regions at a location near to the magnetic equator. These results show that there is a sharp increase in the elongation of the diffraction pattern on the ground, in the direction of the earth's magnetic field, for echoes from above 90 km. Consideration of the relative rates of diffusion of irregularities, parallel and perpendicular to the earth's magnetic field, shows that the height at which the ionosphere might be expected to become appreciably anisotropic, with respect to the ambipolar motions of electrons and positive ions, is in good agreement with the experimental results. Author

N63-10135 Ghana U., Legon
A ROTATING AERIAL BACK-SCATTER SOUNDER Technical Note No. 4
B. R. Clemesha Aug. 10, 1962 22 p Project title: Equatorial Study of Irregularities in the Ionosphere
(Contract AF 61(052)-421)
(AFCRL-62-903)

Description of a back-scatter sounder designed for the investigation of irregularities associated with equatorial spread F. Author

N63-10147 Rhode Island U., Kingston
DIURNAL VARIATION AND SOME OTHER CHARACTERISTICS OF EXTREMELY LOW FREQUENCY MAGNETIC FIELDS Scientific Report No. 2
C. Polk Aug. 2, 1962 37 p 21 refs
(Contract AF 19(604)-7252)
(AFCRL-62-734)

Amplitude versus time records of 2-minute duration of North-South and East-West magnetic field variations in the 5 to 20 c/s frequency range, and 24-hour records of 7.5 to 10 c/s magnetic fields which were obtained over a period of several months are analyzed. It appears that the most prominent frequency of individual wave trains in this frequency range is not constant, that some imperfect correlation exists between ELF noise and solar activity, and that 7.5 to 10.0 c/s ELF intensity (recorded on an East-West coil) is normally higher during daylight hours than the corresponding ELF intensity recorded at night. The diurnal variation of ELF intensity averaged over a 75-day period between April and July 1962 closely resembles the diurnal variation of thunderstorm activity in the Western hemisphere, based upon data accumulated before 1960. Author

N63-10168 Illinois U. Electrical Engineering Research Lab., Urbana
A METHOD OF DETERMINATION OF IONOSPHERIC ELECTRON DENSITY PROFILES FROM FARADAY ROTATION OF SATELLITE BORNE RADIO SIGNALS
Victor Gonzalez (Ph.D. Thesis) Sept. 1962 59 p 24 refs
(NASA Grant NsG-24-59)
OTS: $5.60 ph, $1.97 mf

A detailed analysis is made of Faraday rotation records received at a ground station from a transmitting satellite. A set of parameters of a Chapman ionosphere model is assumed, and the Faraday effect corresponding to a given satellite passage is calculated by means of an electronic computer using the ray-tracing technique. The calculated result is compared with the experimental observations to generate a new set of parameters. The whole calculations are then repeated with the new ionosphere until the differences between the calculated and experimental values have been minimized. Since the ray tracing requires the longest computer time in this self-consistent approach, it is found that, in most cases, a second order formula is much simpler to use and with almost equal satisfaction. The phenomenon of one hop propagation when the satellite moves below the height of maximum electron density and the occurrence of the minima and maxima in the number of Faraday rotations between satellite and station are examined. Author

N63-10189 Avco Corp. Research and Advanced Development Div., Wilmington, Mass.
RESEARCH CONCERNING FORECASTING ANOMALOUS PROPAGATION AT HIGH LATITUDES: THE GENERATION AND EFFECT OF ELECTROSTATIC FIELDS DURING AN AURORAL DISTURBANCE Scientific Report No. 17
Daniel W. Swift Nov. 9, 1962 23 p 9 refs
(Contract AF 19(604)-4092)
(RAD-TM-62-88; AFCRL-62-758)

The equations of motion of electrons and ions in the presence of electric, magnetic, and neutral particle velocity fields are derived for conditions which are apt to exist in an auroral arc. The electric field resulting from charge separation is computed. Electron densities, charged particle motion, and electric currents are also computed. It is shown how these computations can account for magnetic bays, electron drifts, and electric field fluctuation observed during auroral disturbances. Analytical expressions for electric field strengths and neutral plasma drift velocities are derived. Author

N63-10191 Barringer Research Limited, Rexdale (Canada)
DICON EXPERIMENTAL MEASUREMENTS Final Report
A. R. Barringer, J. D. Crone, and D. Bray Aug. 31, 1962 38 p 16 refs
(Contract AF 19(628)-443)
(AFCRL-62-1018)

A study is made of the physical properties of the ground by the use of the DICON method. Results with this method suggest that it is capable of yielding information on ground characteristics down to depths of 50 feet or more. It was concluded that the optimum frequency for use in a practical DICON airborne system for trafficability studies would be VHF frequency in the range of 150 to 250 megacycles. At this frequency, conductivity would not affect the measurements, interpretation would be greatly simplified, and furthermore, penetration would lie in those ranges which have the most effect upon trafficability. J.R.C.

N63-10226 Lincoln Lab., Mass. Inst. of Tech., Lexington
RADAR METHODS OF STUDYING THE EARTH'S IONOSPHERE
John V. Evans *In* Virginia Polytechnic Inst., Blacksburg. Physics of the Solar System, Part I. Proc. of the Conf. on Physics of the Solar System and Reentry Dynamics, July 31 to Aug. 11, 1962 p 166-209 96 refs (See N63-10220 01-05) VPI: $1.50

Recent studies of the ionosphere are reviewed to compare their results to present theories of the F region. The methods used in these studies include radar reflections from the moon and radar incoherent scatter. While these methods have not furnished a wealth of results comparable with those of ionosondes, the studies support the theory for the F_2 region advanced by Yonezawa. It is shown that a small modification of the theory proposed by the Cambridge group will yield a hypothesis which is capable of accounting for (a) the diurnal variation of the F_2 region, (b) the geomagnetic anomaly, and (c) the temperate latitude winter anomaly. R.C.M.

N63-10227 Lincoln Lab., Mass. Inst. of Tech., Lexington
RADAR STUDIES OF PLANETARY SURFACES
G. H. Pettengill *In* Virginia Polytechnic Inst., Blacksburg. Physics of the Solar System, Part I. Proc. of the Conf. on Physics of the Solar System and Reentry Dynamics, July 31 to Aug. 11, 1961 p 210-236 33 refs (See N63-10220 01-05) VPI: $1.50

Radar studies of the planetary and lunar surfaces are reviewed to point out the principal contributions they have made to knowledge of these bodies. The data obtained from these studies include the path loss, echo delay, Doppler shift, and surface effects. These data have provided knowledge of the moon and planets in three major areas: (1) the dynamics of the orbits, (2) the composition of the materials of the surface, and (3) the geography of surface features visible at radio-wavelengths. R.C.M.

N63-10233 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROPERTIES OF THE ATMOSPHERE
Richard A. Hord *In* Virginia Polytechnic Inst., Blacksburg. Reentry Dynamics, Part II. Proc. of the Conf. on Physics of the Solar System and Reentry Dynamics, July 31 to Aug. 11, 1961 p 75-92 21 refs (See N63-10230 01-01) VPI: $2.00

The properties of the atmosphere of interest in reentry dynamics are discussed. The hydrostatic equation and the geopotential concept are introduced and illustrated by a simple model for which the molecular-scale temperature is assumed constant. Standard and model atmospheres are described and altitude profiles are shown for thermodynamic properties, mean molecular weight, and electron concentration. The available information on winds and the radiative properties of the atmosphere are outlined. Author

N63-10234 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE THERMODYNAMIC PROPERTIES OF HIGH TEMPERATURE AIR
John S. Evans *In* Virginia Polytechnic Inst., Blacksburg. Reentry Dynamics, Part II.1 Proc. of the Conf. on Physics of the Solar System and Reentry Dynamics, July 31 to Aug. 11, 1961 p 93-107 31 refs (See N63-10230 01-01) VPI: $2.00

The thermodynamic properties of air, which are important for analysis of the aerodynamic and heat transfer problems encountered under reentry conditions, are reviewed. The changes induced in gas properties by the shock wave associated with a high-speed object in the atmosphere are discussed, including the effect of chemical reactions and ionization. High-speed flight heats air to temperatures such that its thermodynamic properties are altered. Since these properties enter into the aerodynamic calculation of lift, drag, and heat transfer, it is important that the properties be evaluated. The most suitable means for accomplishing this is by the calculation of the partition function and its derivatives, using spectroscopically measured values of the atomic and molecular states needed. J.R.C.

N63-10275 Aerospace Information Div., Library of Congress, Washington, D.C.
GEOMAGNETIC ACTIVITY
Oct. 25, 1962 2 p Review of: V. M. Mishin and I. A. Zhulin Some problems of geomagnetic activity. I. Geomagnetizm i Aeronomiya (Moscow), v. 2, no. 3, May-June 1962 p 502-509 (AID-62-166) OTS: $1.10 ph, $0.80 mf

Recent contributions of Soviet scientists to geomagnetic storm theory are summarized as follows: (1) It has been established that magnetic activity is a periodic function with a 24-hour period, and dependent on the latitude and season of the year; (2) short-period magnetic fluctuations (10 to 10^3 sec) have been shown to differ during the day and night hours; (3) statistical regularities D_t (field of irregular disturbances) should describe the correlation of geomagnetic activity with polar auroras, with disturbances in the ionosphere, and with the space-time distribution of D_t. R.C.M.

N63-10276 Aerospace Information Div., Library of Congress, Washington, D.C.
EFFECT OF THE EARTH'S ROTATION ON ATMOSPHERIC AND HYDROSPHERIC PROCESSES
Nov. 13, 1962 3 p Review of: N.S. Sidorenkov Effect of the nonuniform rotation of the earth on atmospheric and hydrospheric processes Problemy Arktiki i Antarktiki (Leningrad), no. 9, 1961 p 45-49
(AID-62-175) OTS: $1.10 ph, $0.80 mf

Variations in the earth's rotation have been analyzed for their effects on the atmospheric and hydrospheric processes. Three types of variation in the angular velocity of the earth are considered: secular retardation, irregular fluctuations, and periodical seasonal variations. These variations in velocity alter the centrifugal forces produced by planetary rotation, and ultimately lead to a redistribution of mass. Equations are presented to determine the changes in atmospheric pressure and velocity that are brought about by the vertical and horizontal deforming forces of redistribution. These forces are shown to affect the velocity of water mass currents and also the ocean level. R.C.M.

N63-10295 Royal Technical U. of Denmark. Ionosphere Lab., Copenhagen
DIRECT OBSERVATION OF CORRELATION BETWEEN AURORA AND HISS IN GREENLAND Technical Note No. 2
Torben Stockflet Jørgensen and Eigil Ungstrup Feb. 27, 1962 7 p 1 ref
(Contract AF 61(052)-298)
(*Its* Report 11; AFCRL-62-1033)

In Godhavn, Greenland, simultaneous visual observation of auroras and listening to 8 kc/s hiss was made during January and February 1961. During these observations, a close correlation was found between the instantaneous strength of the hiss and the activity as well as the intensity of the auroras. Author

N63-10312 Iowa State U., Iowa City
A LARGE DIURNAL VARIATION OF THE GEOMAGNETICALLY-TRAPPED RADIATION
B. J. O'Brien [1962] 25 p 12 refs
(NASA Grant NsG-233-62; Contract N9onr-93803)
(SUI-62-23-A) OTS: $2.60 ph, $0.95 mf

The satellite Injun I was used to find the high latitude termination of trapping of electrons with energy $E \geq 40$ keV at 1000 km altitude over North America. On the average, this termination is at $L \sim 16$ or $\Lambda \sim 75°$ in the local day and at $L \sim 8$ or $\Lambda \sim 69°$ in the local night. As a consequence, in the range $8 \leq L \leq 16$ or $69° \leq \Lambda \leq 75°$, the average intensity of trapped electrons is some one hundred times greater in the local day than it is at local night. Several explanations are suggested but none is proven. The results show that McIlwain's L parameter loses its simple applicability for $L \geq 6$ or $\Lambda \geq 66°$. Author

N63-10435 Centre National de la Recherche Scientifique. Observatoire de Meudon (France)

NEW DIRECT MEASURMENTS OF IONOSPHERIC TEMPERATURE

J[acques] E[mile] Blamont and M. L. Lory Repr. from Wesler, I RSM. Amsterdam, North-Holland Publishing Co., [1961] 5 p 2 refs

(NASA Contract NASr-77)

(Reprint 1.5)

The principle of temperature determination from spectroscopic analysis of the light emitted by chemicals released in the high atmosphere is described. The results of two measurements made at Wallops Island at 200 and 400 km in the morning and evening of September 13, 1961 are presented and compared with measurements made in December 1960. Author

N63-10459 Massachusetts Inst. of Tech. Research Lab. of Electronics, Cambridge

A METHOD FOR THE DETERMINATION OF HIGH-ALTITUDE WATER-VAPOR ABUNDANCE FROM GROUND-BASED MICROWAVE OBSERVATIONS

A. H. Barrett and V. K. Chung Repr. from J. Geophys. Research, v. 67, no. 11, Oct. 1962 p 4259-4266 20 refs

(NASA Grant NsG-250-62 and NASA Contract NASr-101)

The microwave resonance line at 22,235 Mc/s (λ = 1.35 cm) arising from uncondensed H_2O in the terrestrial atmosphere is examined in detail as a means of providing easily obtained data on the physical structure of the atmosphere. It is shown that the line profile is drastically influenced by the vertical distribution of H_2O, and that the anomalous abundance of uncondensed H_2O above 15 to 20 km should be easily detected and monitored by ground-based passive microwave observations. The method, capable of 24-hours-per-day operation, can be used to determine abundance changes on a time scale as short as several seconds, if necessary, and to reveal horizontal fine structure with a resolution of 150 meters at an altitude of 30 km with a 10-foot parabolic receiving antenna. Author

N63-10460 California U., Los Angeles. Inst. of Geophysics and Planetary Physics

IMPLICATIONS OF THE DISCOVERER XVII SATELLITE DATA: THE MECHANISM OF ATMOSPHERIC LOSS FROM THE EARTH AND THE PRODUCTION OF H^3 AND He^3 IN SOLAR FLARES

E. Flamm, R. E. Lingenfelter, Gordon J. F. McDonald, and W. F. Libby [1962] 10 p 37 refs

(NASA Grants NsG-237-62 and NsG-216-62; Grant NSF-G-13575)

OTS: $1.10 ph, $0.80 mf

The solar flare radiation intercepted by Discoverer XVII is reviewed to point out the implications of this data to geophysics and solar physics. The amounts of H^3 and He^3 recovered from the satellite were two orders of magnitude too large to be accounted for by spallation of the casing material. From this and data on the energies of the protons in the solar flare of November 12, 1960, it is indicated that H^3 and He^3 are produced by He^4 (p,2p)H^3, He^4(p,pn)He^3, and He^4(p,d)He^3 reactions. It is shown that the composition of the November 12 solar radiation can be accounted for by the Gold and Hoyle flare model. R.C.M.

N63-10483 Sandia Corp., Albuquerque, N. Mex.

A SCALE-MODEL EXPERIMENT OF THE CRATER PRODUCED THROUGH TERRAIN OF RANDOMLY VARYING ELEVATION BY ROW CHARGES (A Contribution to the Plowshare Program) Research Report

L. J. Vortman Nov. 1962 23 p 8 refs

(SC-4735(RR)) OTS: $0.75

A scale-model experiment was made to check the application of charge spacing rules developed from earlier studies to terrain of randomly varying elevation. Since a prominent possible peacetime use of nuclear explosives is the excavation of a trans-Isthmian canal, the model used was a portion of such a route. The experiment resulted in nearly the desired linear crater dimensions; the spacing rules developed for level terrain give a satisfactory channel when applied to terrain with elevations varying in a random fashion. Author

N63-10486 Auckland U. (New Zealand)

VARIATIONS IN THE TOTAL ELECTRON CONTENT OF THE IONOSPHERE AFTER THE HIGH ALTITUDE NUCLEAR EXPLOSION

J. E. Titheridge [1962] 7 p 2 refs Prepared for journal publication

(NASA Grant NsG-54-60)

OTS: $1.10 ph, $0.80 mf

From measurements of the amplitude of the 54 Mc/s signals from the satellite Transit 4A, the total electron content of the ionosphere up to a height of 920 km is calculated; 35 minutes after the high altitude explosion the electron content over Auckland was twice the normal value of 4.2×10^{16} electrons/m^2. South of Auckland the electron content increased to about three times the normal value over Nelson. The Faraday fading of the signals almost completely disappeared north of Auckland, and this effect cannot be explained by normal ionospheric absorption of the extraordinary component. Author

N63-10505 RAND Corp., Santa Monica, Calif.

THE ADIABATIC INTEGRAL INVARIANT IN THE GEOMAGNETIC FIELD

E. C. Ray, E. H. Vestine, L. Wombolt, and W. L. Sibley Oct. 1962 38 p 7 refs

(NASA Contract NASr-21(05))

(RM-3347-NASA) OTS: $3.60 ph, $1.34 mf

The spatial distribution of the trapped radiation in the various Van Allen regions of the magnetosphere is determined by the geomagnetic field. If the radiation flux in equilibrium is measured at any point in a Van Allen region, the flux elsewhere within a shell encircling the earth can be estimated when the geomagnetic field B and the integral adiabatic invariant I are known. Tables of B and I, computed for all except the outer part of the magnetosphere, are listed in the present report. The values of I are expressed in a spherical harmonic series of 196 terms, appropriate to values B expressed by the Finch and Leaton coefficients for B to P_5^5 for 1955.0. Author

N63-10539 Joint Publications Research Service, Washington, D.C.

EVALUATION OF THE INFLUENCE OF TURBULENT SCATTERING ALONG THE VERTICAL AND IN THE DIRECTION OF THE WIND ON THE PROPAGATION OF A POLYDISPERSED ADMIXTURE

V. N. Petrov and A. Ya. Pressman (Inst. of Applied Geophys., Acad. of Sci., USSR) Dec. 3, 1962 10 p 6 refs Transl. of article from Doklady Akad. Nauk SSSR (Moscow), v. 146, no. 1, 1962 p 86-88 (JPRS-16492) OTS: $1.10

An evaluation is made of the influence of turbulent scattering along the vertical and in the direction of the wind on the propagation of a polydispersed admixture. The difference in the fall velocities of admixture particles leads to scattering along the vertical and produces the same effect as the vertical turbulence. It is shown that during precipitation of sufficiently inhomogeneous admixture that a comparison of the parameters a and /n/ permits an isolation of a time interval in which it is possible to disregard the turbulent scattering of the admixture along the vertical. The error is on the order of Δ without taking into account the vertical diffusion. J.R.C.

N63-10552 Rome Air Development Center. Space Defense Systems Lab., Griffiss AFB, N. Y.

H-F PROPAGATION SIMULATION

R. Mather and F. Wilson Nov. 1962 26 p 6 refs

(RADC-TDR-62-473)

An experiment is described in which high-frequency electromagnetic wave propagation is to be simulated on an analog computer and compared with experimental data collected over a 3800-km path. The experimental complex consists of a transmitter site located in the Panama Canal Zone and a receiver site at Stockbridge, N.Y. Vertical ionospheric sounders are located along the transmission path and are used to measure the spatial distribution of electron density in the volume of interest. A method is described whereby this spatial distribution of electron density is programed into the analog computer in order that the Hamiltonian equations describing ray paths may be solved. In addition to producing frequency vs. time plots for comparison with the experimental data, the simulator also gives results not easily measured in the field, such as takeoff angle, angle of arrival, group time, phase time, off-path deviation, and height of reflection. An alternate use for the simulator is also presented. By rescaling the problem and making use of its capability to generate functions of three variables, one can examine the effects of small-scale irregularities of ionization on electromagnetic waves. Author

N63-10565 Joint Publications Research Service, Washington, D.C.
CONCERNING THE DIURNAL PATTERN OF PROBABILITY ZONES OF INCREASED TURBULENCE AT HIGH ALTITUDES
M. V. Zavarina Dec. 3, 1962 12 p 4 refs Transl. of an article from Trudy Glavnoi Geofiz. Observatorii im. A. I. Voikova (Leningrad) 1962 p 45-51
(JPRS-16458) OTS: $1.60

The paper examines the diurnal pattern of probability zones of increased turbulence with which the formation of appreciable oscillations of an airplane is connected. The presence of these zones is established by a refined criteria of Richardson. For identification of the diurnal change of probabilities, data are used from temperature-wind soundings made by three aerological stations during four months from 1952 to 1957. During warm parts of the year, a diurnal pattern appeared significantly in the lower kilometer layers of the atmosphere. Author

N63-10568 National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York, N. Y.
THE MAGNETOSPHERE
Robert Jastrow Repr. from Trans. N. Y. Acad. Sci., Ser II, v. 24, no. 6, Apr. 1962 p 690-703 Abstract of this paper presented at the Lectures in Aerospace Medicine Symposium, Brooks AFB, Tex., Jan. 11, 1962

The present knowledge of the magnetosphere is reviewed to introduce a study of the sequence of observations of the solar events of March and November 1960. Twenty-two hours after the March flare a magnetic storm began, accompanied by a decrease of cosmic ray ac intensity. About one hour after the flare, 100 mev protons were detected near the polar regions. This shows that the magnetic fields in the plasma cloud produced by the flare reduced to transit time by a factor of 3. After the November flare, the magnetic storm occurred in 40 hours. R.C.M.

13 HEAT TRANSFER

Includes: ablation; cooling; heating; and other thermal effects.

For aerothermodynamics see: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; and 03 Aerodynamics of Wings and Control Surfaces.

For combustion see: 26 Propellants and Combustion.

For related information see: 11 Fluid Mechanics.

N63-10016 Aerodynamische Versuchsanstalt, Göttingen (W. Germany)
WÄRMEÜBERGANGSPROBLEME BEI HYPERSONISCHEN GRENZSCHICHTEN [HEAT TRANSFER PROBLEMS IN HYPERSONIC BOUNDARIES]
J. C. Rotta [1962] 28 p 13 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-11, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 19) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

With reentry of a space vehicle or ballistic body into the atmosphere, a portion of the kinetic energy, which has been dissipated in the air barrier, becomes sublimated as heat in the passage through the boundary layer. To minimize the amount of heat transferred, a body of sizable resistance (a blunt body) is requisite. A comparison of the various possibilities of protecting the maximum load and equipment from the intolerable heat indicates the superiority of of heat shielding by ablation with respect to loss of mass as opposed to heat shielding through heat accumulation. The mechanics of flow on the body through the occurrence of the real-gas effect is described as dissociation, recombination, and ionization. With ablation, a reciprocity is found between the boundary layer flow and the wearing away of material. M.B.S.

N63-10092 Brown U., Providence, R. I.
THE VISCOSITY OF SUPERHEATED STEAM UP TO 275° C. A REFINED DETERMINATION
J. Kestin and P. D. Richardson Sept. 1962 34 p 10 refs Prepared for journal publication
(Contract Nonr-1858(25); Proj. Squid)
(Tech. Rept. BRN-1-P)

This report describes a series of measurements made with an oscillating disk viscometer of the viscosity of superheated steam. These measurements were made on eight isotherms, ranging from 148° C to 275° C, and thus go to a temperature higher than previously achieved with steam in this type of instrument. The measurements again show that in the range of temperature investigated the viscosity of superheated steam decreases with increased density. The precision of the present measurements has permitted a simple correlation to be made of the effect of temperature and density upon the viscosity. From this it now appears that the temperature at which the density effect ceases to be negative is about 315° C. Author

N63-10109 Aerojet-General Corp., Sacramento, Calif.
HEAT TRANSFER AND PARTICLE TRAJECTORIES IN SOLID-ROCKET NOZZLES Technical Note
L. P. Travis Oct. 19, 1962 53 p 1 ref
(Contract AF 33(600)-36610)
(Rept. 0162-01TN-17; AFBSD-TDR-62-165)

A computer program has been developed for analog and digital computers to determine particle trajectories in the aft closures and exit cones of Minuteman second-stage motors. Equations of motion also have been made suggesting nozzle geometries which minimize particle impingement. Author

N63-10132 Stanford U., Calif.
MEASUREMENTS OF PRESSURE AND SPEED OF FLOW IN A SPARK-HEATED HYPERSONIC WIND TUNNEL
Krishnamurty Karamcheti, Walter Vali, James B. Kyser, and Maurice L. Rasmussen Arnold AF Station, Tenn., Arnold Engineering Development Center, Nov. 1962 56 p 15 refs
(Contract AF 40(600)-930)
(AEDC-TDR-62-218)

An account is given of several aspects of the experimental investigation directed at determining the nature of the flow and

state of the gas in the nozzle and test section of the Stanford spark-heated hypersonic wind tunnel. Attention is given only to the pressure and speed-of-flow measurements. Results are presented for pitot pressures and wall static pressures. The speed of flow in the test section is derived from measurements made by spark-schlieren photographs of a disturbance created in the flow by means of a spark discharge. On the basis of these measurements, it is concluded that the actual stagnation enthalpy of the stream is likely to be different from the enthalpy calculated according to current practice. As a consequence, it is shown that serious errors may occur in the calculated values for the state of the flow, and in theoretical estimates of quantities such as stagnation-point heat-transfer rates. Author

N63-10173 National Aeronautics and Space Administration, Washington, D.C.

HEAT-TRANSFER CHARACTERISTICS OF SEVERAL RADIATOR FINNED-TUBE CONFIGURATIONS

W. J. Minkowycz (Minnesota U.) and E. M. Sparrow Nov. 1962 47 p 6 refs

(NASA TN D-1435) OTS: $1.25

An analytical study was performed to provide information on the heat loss to space from three radiator finned-tube configurations in which there is radiant interaction between fins and tubes. Numerical results for the heat-transfer characteristics of these configurations were obtained under the condition that the surfaces are blackbody radiators. A comparison showed the heat-loss results for the various configurations to be of very similar magnitude for equal fin weight. A method of analysis for the case of nonblack diffuse surfaces was also formulated. Author

N63-10175 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio

ON THE EFFECT OF HEAT ADDITION IN THE EMPIRICAL CORRELATION OF VOID FRACTIONS FOR STEAM-WATER FLOW

Uwe H. von Glahn and Richard P. Polcyn Washington, NASA, Nov. 1962 38 p 13 refs

(NASA TN D-1440) OTS: $1.00

An empirical equation is presented that closely approximates experimentally measured void fractions in steam-water flow obtained with heat addition to the fluid in terms of the steam quality, the ratio of the density of the fluid phases, a heat-addition parameter, and a fluid-property parameter. Author

N63-10207 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

HELIUM FILM COOLING ON A HEMISPHERE AT A MACH NUMBER OF 10

Robert E. Dannenberg Washington, NASA, Nov. 1962 27 p 13 refs

(NASA TN D-1550) OTS: $0.75

A shock-tunnel investigation has been made of the heat-transfer rate to a hemisphere at a stagnation temperature of 8,700° R. Models tested were equipped for tangential injection of a helium film coolant in the stagnation region. Thermocouple measurements were made of the reduction in local heat transfer for various coolant flow rates and two injection arrangements. The range of the ratio of velocities at the helium-air interface at injection was from 1.2 to 6. Author

N63-10332 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

HEAT AND MOMENTUM TRANSFER IN SMOOTH AND ROUGH TUBES AT VARIOUS PRANDTL NUMBERS

Duane F. Dipprey and Rolf H. Sabersky June 6, 1962 37 p 17 refs

(NASA Contract NAS7-100)

(JPL-TR-32-269) OTS: $3.60 ph, $1.31 mf

Results are presented from an experimental investigation of the relation between heat transfer and friction in smooth and rough tubes. Three rough tubes and one smooth tube were formed from electroplated nickel. The rough tubes contained a close-packed, granular type of surface with roughness-height-to-diameter ratios ranging from 0.0024 to 0.049. Measurements of the heat transfer coefficients (C_H) and the friction coefficients (C_f) were obtained with distilled water flowing through the electrically heated tubes. A Prandtl number range of 1.20 to 5.94 was investigated by adjusting the bulk temperature of the water. Results were obtained for Reynolds numbers from 6×10^4 to 5×10^5 and from 1.4×10^4 to 1.2×10^5 at the lowest and highest Prandtl number, respectively. Increases in C_H due to roughness of as high as 270% were obtained. These increases were, in general, accompanied by even larger increases in C_f. An exception to this general behavior occurs at high Prandtl number in the region of transition between the "smooth" and "fully rough" C_f characteristic. Author

N63-10344 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

HEAT TRANSFER OF WAVE STRIPS IN A LONGITUDINAL AIR STREAM

O. O. Kremnev and M. T. Dukhnenko Sept. 21, 1962 6 p 3 refs Transl. from Akad. Nauk Ukr. SSR, no. 11, 1961 p 1495-1497

(FTD-TT-62-971/1+2)

A study is made of the heat transfer of thin corrugated strips in a longitudinal flow of air. A comparison of the coefficients of heat transfer of wavy strips with those of straight strips showed that the rate of air flow can be tripled for corrugated strips. This is due to the fact that a wavy (corrugated) surface appears as an elementary strip on which the boundary layer, not having sufficient time to form, becomes ruined. The results show that with the aid of artificial ruination of the boundary layer it is possible to considerably intensify the process of heat transfer for wavy strips. The applications of such wavy strips during the construction of heat exchange surfaces for industrial heat exchangers will offer the possibility of reducing their overall dimensions, cut metal consumption, and raise the efficiency of the installation. J.R.C.

N63-10346 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

EXPERIMENTAL INVESTIGATION OF HEAT EXCHANGE OF A PLATE WITH LONGITUDINAL AIR FLOW DIRECTED AROUND IT

A. N. Chaplina Oct. 10, 1962 9 p 5 refs Transl. from Inzhenerno-Fiz. Zhur. (Minsk), v. 5, no. 7, 1962 p 34-38

(FTD-TT-62-1413/1+2)

Heat transfer coefficients are determined along the length of a plate and compared to calculated values. The model of the plate with two-sided work surface was placed parallel to the flow. Baffle washers were placed on the model to eliminate boundary effects. Measurements were obtained from four calorimeters at flow velocities of from 4 to 16 m/sec and flow temperatures of 60°, 70°, 80°, and 100° C. The results of these tests differ by 8% from the data calculated by general formulas. R.C.M.

N63-10380 Boeing Co. Aero-Space Div., Seattle, Wash.

EXPERIMENTAL STUDY OF THE EFFECTS OF SURFACE IRREGULARITIES ON THE HYPERSONIC AERODYNAMIC HEAT TRANSFER TO A FLAT PLATE

Paul G. Kafka and Loren H. Anderson *In* Air Force Systems Command. Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif. Transactions of the 7th Symp. on Ballistic Missile and Space Technol., U.S. Air Force Academy, Colo., Aug. 13-16, 1962 Vol. I p 255-291 14 refs (See N63-10370 01-01)

(Contract AF 33(600)-41517)

The effects of surface irregularities upon aerodynamic heat transfer in hypersonic flow have been investigated. Heat transfer

coefficients and pressures have been measured in the presence of notches, forward and backward facing steps, and sine wave type corrugations normal to the flow. All these irregularities caused separation and reattachment of the flow. The measured quantities are ratioed both to laminar and turbulent flat plate values. The effects of Mach number, Reynolds number, and angle of attack were also investigated. All irregularities were found to cause localized heating peaks, some with magnitudes over twice turbulent flat plate values. Author

N63-10382 Aeronutronic, Newport Beach, Calif.

THE PREDICTION OF HEAT TRANSFER AND ABLATION IN THE AFTCLOSURE OF A SOLID PROPELLANT ROCKET MOTOR

W. C. Kuby, Jr., and J. L. Richardson *In* Air Force Systems Command. Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif. Transactions of the 7th Symp. on Ballistic Missile and Space Technol., U.S. Air Force Academy, Colo., Aug. 13-16, 1962 Vol. I p 325-364 45 refs (See N63-10370 01-01)
(Contract AF 04(611)-7047)

A mathematical design model has been developed for the prediction of insulation requirements in the aft-closure of a solid-propellant rocket motor. This model and the associated calculation technique represent only a first approximation to the exact solution of a problem concerned with various complex phenomena. The behavior of ablative elastomeric insulation materials in such an application is considered. The choice of the assumptions used to calculate the forced convective and radiative heat fluxes is based on recent experimental results. A summary is made of the information still to be determined in order that this model can be fully utilized. Author

N63-10385 Lockheed Missiles and Space Co., Sunnyvale, Calif.

PROBLEMS IN THE OXIDATION PROTECTION OF REFRACTORY METALS IN AEROSPACE APPLICATIONS

R. A. Perkins, L. A. Riedlinger, and S. Sokolsky *In* Air Force Systems Command. Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif. Transactions of the 7th Symp. on Ballistic Missile and Space Technol., U.S. Air Force Academy, Colo., Aug. 13-16, 1962 Vol. I p 420-450 12 refs (See N63-10370 01-01)

This paper presents an evaluation of protective coatings for refractory metals and critical problem areas in the light of requirements for radiation equilibrium cooled structures. Environmental conditions of temperature, pressure, flow, and time for hypersonic reentry vehicles are described. The effect of atmospheric pressure and flow on the performance of the most promising coating systems is discussed. Data are presented to show that rapid deterioration of silicide-base coatings can occur under reentry environmental conditions. Current oxidation test data can be misleading and potential uses of coated structures should be re-assessed. Improved coatings must be developed for use in low-pressure environments. Author

N63-10447 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

A STUDY OF THE PROCESS OF CONVECTIVE HEAT TRANSFER IN WINDING SLIT CHANNELS

L. M. Kovalenko Aug. 30, 1962 11 p 8 refs Transl. from Teploenerg. (SSSR), no. 2, 1962 p 77-79
(FTD-TT-62-1175/1+2+4)

A model of a laminated heat exchanger composed of plates with herringbone corrugations has been studied to determine its convective heat-transfer characteristics. The heat exchanger is composed of nine plates which fit together to form four cooling and four heating slit channels. Within the range of flow velocities studied, 0.05 to 1.20 m/sec, the results agree to within 6% of the theoretical values. R.C.M.

N63-10458 Rensselaer Polytechnic Inst., Troy, N. Y.

HEAT TRANSFER AND WATER REMOVAL IN CYLINDER DRYING. II. FELTED CYLINDERS

H. H. George, Jr. (duPont de Nemours (E.I.) and Co., A. H. Nissan, and D. Hansen Repr. from Tappi, v. 45, no. 3, Mar. 1962 p 213-218 9 refs
(NASA Grant NsG-100-60)

An earlier theory of the heat and mass transfer on unfelted drying cylinders has been extended to include felted cylinders. Data from an experimental cylinder drier are compared with the theory. An analysis of the experimental drying data is presented in terms of the various mechanisms for water removal on a cylinder drying machine. It was found that the heat transfer through the sheet could be satisfactorily described in terms of conduction alone for cylinder temperatures below the boiling point of water. At higher temperatures, convection mechanisms become increasingly more important. The extraction of water by the felt also increased with the cylinder temperature, the increase being especially marked near the normal boiling temperature for water. Author

N63-10477 Brown U., Providence, R. I.

ESTIMATION OF THE HEAT TRANSFER FROM THE REAR OF AN IMMERSED BODY TO THE REGION OF SEPARATED FLOW [Interim Technical Report]

P. D. Richardson Wright-Patterson AFB, Ohio, Aeronautical Research Labs., Sept. 1962 30 p 39 refs
(Contract AF 33(616)-5756)
(ARL-62-423; supersedes WADD-TN-59-1)

The region of separated flow on a bluff body in a transverse stream of fluid is considered. An approximate method is described to calculate the convective heat transfer. It is applied to a cylinder in a transverse air stream, and the results are compared with experimental data in the literature. The agreement is good. The method may also be applied to other body shapes. Author

N63-10511 General Electric Co. Space Sciences Lab., Philadelphia, Pa.

THE ABLATION OF GRAPHITE IN DISSOCIATED AIR. PART II: EXPERIMENTAL INVESTIGATION

N. S. Diaconis, P. D. Gorsuch, and R. A. Sheridan Sept. 1962 36 p 8 refs Presented at the IAS National Summer Meeting, Los Angeles, June 19-22, 1962
(R62SD86 – Class I)

An experimental investigation was conducted to study the oxidation performance of ATJ graphite in dissociated air. To characterize the behavior of such a material in a reentry environment requires the proper simulation of certain free flight flow field parameters which greatly influence material performance. For good experimental simulation it is desirable to establish in the test facility at least the following: stagnation enthalpy of the gas stream, model pressure, flow chemistry and aerodynamic shear. Tests were conducted in a hypersonic arc wind tunnel in which the material mass loss was correlated as a function of model surface temperature. The data obtained indicated two specific zones of material performance, one in which the rate of the reaction between the oxygen species and the material governs the mass loss and the other in which the rate of diffusion of the oxygen-bearing species to the surface is dominant. Comparison of these experimental data with the theory of Scala showed good agreement. Author

N63-10515 General Electric Co. Space Sciences Lab., Philadelphia, Pa.

THE ABLATION OF GRAPHITE IN DISSOCIATED AIR. I. THEORY

Sinclaire M. Scala Sept. 1962 92 p 7 refs Presented at the IAS National Summer Meeting, Los Angeles, June 19-22, 1962
(R62SD72–Class I)

An analysis is presented of the combustion of graphite in a high-speed stream of dissociated air. Many features of the analysis are quite general and may be applied to the oxidation of different materials in arbitrarily chemically reactive environments. However, because of the current interest in the hypersonic leading-edge problem, numerical results are presented here which are directly applicable to surface oxidation at the leading-edge region of fins and wings, and the nose cap of axially symmetric hypersonic vehicles. Author

N63-10523 Atomic Energy Commission. Div. of Technical Information, Washington, D.C.

PROBLEMS OF HEAT TRANSFER

M. A. Mikheev, ed., et al Jan. 1962 248 132 refs Transl. by JPRS of "Voprosy Teploobmena" Moscow, Acad. of Sci. SSSR, 1959 (AEC-TR-4511) OTS: $3.00

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6. AN INVESTIGATION OF HEAT TRANSFER IN A TUBE TO A SODIUM-POTASSIUM ALLOY P. L. Kirillov, V. L. Subotin, M. Ya. Suvorov and M. F. Troyanov p 69-85 13 refs
7. THE AVERAGE HEAT TRANSFER WITH TURBULENT FLOW OF A EUTECTIC BISMUTH-LEAD ALLOY IN SHORT TUBES N. S. Kondrat'ev 86-89 p 3 refs
8. RAPID METHOD OF MEASURING THE AVERAGE HEAT TRANSFER COEFFICIENT IN A TUBE M. N. Ivanovskii p 90-103 8 refs
9. THE APPLICATION OF THE METHOD OF ELECTRICAL ANALOGY TO THE SOLUTION OF RADIANT HEAT EXCHANGE PROBLEMS V. N. Andrianov p 104-113 9 refs
10. HEAT TRANSFER FROM A WALL TO A TURBULENT CURRENT OF AIR WITHIN A TUBE AND THE HYDRAULIC RESISTANCE AT HIGH TEMPERATURE DIFFERENTIALS V. L. Lel'chuk and B. V. Dyadyakin p 114-183 8 refs
11. THE USE OF MICRO THERMOCOUPLES IN STUDYING HEAT TRANSFER M. E. Minshin, V. I. Subbotin, P. A. Ushakov and A. A. Sholokov p 184-191
12. UNIT FOR DETERMINING THE LINEAR EXPANSION COEFFICIENT OF A METAL L. M. Pchelkin p 192-193
13. METALLIZATION UNIT BY EVAPORATION OF A METAL IN VACUUM Yu. A. Korotkov p 194-198 2 refs
14. UNIT FOR MEASURING LIQUID FLOW RATES Yu. A. Korotkov p 199-200
15. VELOCITY AND TEMPERATURE DISTRIBUTIONS WITH TURBULENT FLOW OF A LIQUID IN A CIRCULAR TUBE N. I. Buleev p 201-231 17 refs
16. UNIT FOR DETERMINING THE ABSORPTIVITY OF A SURFACE B. A. Khrustalev p 232-237 8 refs

N63-10534 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

HEAT TRANSFER AND PRESSURE DISTRIBUTIONS ON A HEMISPHERE-CYLINDER AND A BLUFF-AFTERBODY MODEL IN METHANE-AIR COMBUSTION PRODUCTS AND IN AIR

Irving Weinstein Washington, NASA, Dec. 1962 32 p 7 refs
(NASA TN D-1503) OTS: $1.00

Heat-transfer and pressure-distribution data were obtained for hemisphere-cylinders and bluff-afterbody models. The tests were conducted in the test medium of methane-air combustion products and in air alone at Mach numbers from 6 to 9. The results show that the data obtained in the combustion products are in reasonably good agreement with the data obtained in air alone, and can be predicted satisfactorily with existing theories. Author

14 HUMAN BEHAVIOR

Includes: crew training and evaluation; piloting; psychological factors.

For simulators see: 10 Facilities.

For related information see: 16 Life Sciences.

N63-10075 Aerospace Medical Research Labs. (6570th), Aerospace Medical Div., Wright-Patterson AFB, Ohio

SURVEY OF REMOTE HANDLING IN SPACE [Final] Report

D. Frederick Baker, comp. Sept. 1962 42 p 9 refs
(AMRL-TDR-62-100) OTS: $1.25

A survey of industrial opinion on remote handling in space was undertaken to document early concepts and to identify areas of agreement, areas of conflict, and unique ideas relating to the subject. Seven industrial concerns and one military agency provided papers on the role of remote handling in space. These papers are discussed in terms of: (a) remote operations of which there are five major categories—maintenance, assembly, experimentation, transfer operations, and emergency operations; (b) space vehicle design—the manned lightweight capsule, with anthropomorphic gloves, stabilization arms, window ports, and two to three manipulator arms, being representative; (c) manipulator design—concerning actuation, configuration, control, and feedback systems; and (d) space environment factors—vision, weightlessness, temperature fluctuations, high-energy radiation, and micrometeorite collisions. Author

N63-10181 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A STUDY OF A PILOT'S ABILITY TO CONTROL DURING SIMULATED STABILITY AUGMENTATION SYSTEM FAILURES

Melvin Sadoff Washington, NASA, Nov. 1962 36 p 11 refs
(NASA TN D-1552) OTS: $1.00

A comparison of fixed- and moving-cab centrifuge results suggests that moving-cockpit flight simulators should be used for a realistic evaluation of the transient effects of stability augmenter failures since simulator motions generally interfered with the ability of the pilots to adapt to the failures. The pilot was engaged in a simple tracking task when the failures occurred. Simple pilot models are used in the analysis and prediction of the transient effects of failures. Author

N63-10184 Ohio State U. Lab of Aviation Psychology, Columbus

PURSUIT AND COMPENSATORY MODES OF INFORMATION DISPLAY: A REVIEW Technical Documentary Report [Covering Period to Oct. 1961]

George E. Briggs Wright-Patterson AFB, Ohio, Behavioral Sciences Lab., Aug. 1962 18 p 19 refs
(Contract AF 33(616)-6107)
(AMRL-TDR-62-93) OTS: $0.50

This report is a review of the literature on pursuit vs. compensatory modes of display for continuous control (tracking) tasks. It covers published research on this topic to October 1961. The review is concerned only with those research studies in which a comparison was made of the two display modes. The review summarizes both the empirical data and the theoretical interpretations in this research area. Author

N63-10185 Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio

THE EFFECT OF BACK ANGLE, MOLDED SUPPORTS, AND STAGED EVISCERATION UPON INTRAPULMONARY PRESSURES IN DOGS AND A MONKEY DURING FORWARD ($+G_x$) ACCELERATION [Final Report]

Alvin S. Hyde Biomedical Lab., Sept. 1962 16 p 25 refs
(AMRL-TDR-62-106)

Static intrapulmonary pressures were recorded at accelerations from +2 to 16 G_x in live (curarized) and dead dogs and a monkey during forward inclinations of 5° increments from 0° to 45°. The pressures primarily reflect shifts of the diaphragm due to acceleratory forces. The influence of staged evisceration and staged molded support systems was also studied. Essentially null displacement occurred between 10° and 15° of forward inclination. Above and below these angles, diaphragmatic displacement was proportional to acceleration and relatively uninfluenced by molded support systems. Staged evisceration clearly established the literal dependency of diaphragmatic movement upon the presence of the liver. Author

N63-10203 Battelle Memorial Inst., Columbus, Ohio

HUMAN-INITIATED MALFUNCTIONS AND SYSTEM PERFORMANCE EVALUATION [Final] Technical Documentary Report, [Mar. 1961-Aug. 1962]

Roger C. Van Buskirk and Walter J. Huebner Wright-Patterson AFB, Ohio, Behavioral Sciences Lab., Sept. 1962 51 p 17 refs
(Contract AF 33(616)-7968)
(AMRL-TDR-62-105) OTS: $1.50

A discussion is presented of the interaction of human factors activities with other developmental testing activities. The relationship of the human-initiated malfunction to the reliability growth in development is examined. A method for monitoring performance and reliability during development is presented as an aid to determining whether or not a system conforms to its design objectives. Author

N63-10243 National Aeronautics and Space Administration. Space Task Group, Langley Station, Va.

PROJECT MERCURY: THE ROLE OF THE ASTRONAUT IN PROJECT MERCURY SPACE FLIGHTS

Robert A. Voas *In* Virginia Polytechnic Inst., Blacksburg. Reentry Dynamics Part II. Proc. of the Conf. on Physics of the Solar System and Reentry Dynamics, July 31 to Aug. 11, 1961 p 339-350 2 refs
(See N63-10230 01-01) VPI: $2.00

Project Mercury is the nation's primary effort to achieve a manned orbital space-flight capability. In this paper, a development and test program is designed to procure and train the human element in the space system: the astronaut. The integration of this human component into a space vehicle system begins with the basic conception and design of the system itself and proceeds through the detailed design of the controls and displays, the selection of the astronauts, their training, and, finally, with the in-flight evaluation of the human components. Author

N63-10292 Miami U., Coral Gables, Fla.

KNOWLEDGE OF RESULTS IN A MONITORING TASK [Final Report]

Earl L. Wiener (Ph.D. Thesis, Ohio State U.) Wright-Patterson AFB, Ohio, Behavioral Sciences Lab., Aug. 1962 51 p 41 refs (Supported by Grant from Ohio State U. Engineering Experiment Station)
(AMRL-TDR-62-82) OTS: $1.50

An experiment was performed to determine the transfer effect of knowledge of results and signal rate on performance in a Mackworth-type vigilance task. Subjects were run the first day under feedback conditions of zero, partial, and full knowledge of results, and 16, 32, and 48 signals during a 48-minute run. On the second day all subjects were run under the conditions of zero knowledge of results and 32 signals. The results showed that the two experimental variables differentiated subjects on both the initial exposure and the transfer condition. In terms of percentage of signals detected, groups initially trained with knowledge of results and high signal rates showed superior performance on both days. The usual decrement in performance over time was noted on both days. With respect to commissive errors, large individual differences contaminated the results. The data suggest that partial knowledge of results may encourage the operator to make more commissive errors than either zero or full feedback. The findings appear to recommend training with full knowledge of results and high signal rates when an operator must be placed in a situation with no knowledge of results and low signal rates. Author

N63-10293 Ohio State U. Lab. of Aviation Psychology, Columbus

THE EFFECTS OF TASK ORGANIZATION, TRAINING TIME, AND RETENTION INTERVAL ON THE RETENTION OF SKILL [Final] Technical Documentary Report [May 1, 1960-Aug. 31, 1962]

James G. Naylor, George E. Briggs, and Walter G. Reed Wright-Patterson AFB, Ohio, Behavioral Sciences Lab., Sept. 1962 27 p 12 refs
(Contract AF 33(616)-7269)
(AMRL-TDR-62-107) OTS: $0.75

Three variables (amount of training, task organization, and length of the retention interval), each at two levels, were studied to evaluate their influence upon the long-term retention of skill. Subjects were assigned to each of the eight experimental conditions, and were given practice on the criterion task for 2 or 3 weeks. The criterion task was composed of two subtasks, a procedural task involving the learning of discrete responses to discrete stimuli and a tracking task which involved continuous control of a three-dimensional compensatory display. All subjects returned for a retention test either 1 or 4 weeks subsequent to the end of training. Amount of training had a significant influence upon the degree of measured retention loss, as did task organization under conditions of lesser training. This was found for both tracking performance and for the number of omissive errors committed in performing the procedural task. Amount of absolute retention was generally related to (a) amount of training, (b) task organization, and (c) the length of the retention interval. Author

N63-10546 Rocketdyne, Canoga Park, Calif.

HUMAN PERFORMANCE IN THE ATLAS ENGINE MAINTENANCE AREA

George A. Peters, Frank Hall, and Charles Mitchell Feb. 1, 1962 293 p 26 refs
(Contract AF 04(647)-562)
(ROM-2181-1002)

Detailed summary information is given regarding the tests, evaluations, analyses, recommendations, and corrective action undertaken in regard to the human factors problems which were found to affect the MA-3 Atlas propulsion system operation in the engine maintenance area. Author

15 INSTRUMENTATION

Includes: design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gauges; and sensors and transducers.

For related information see: 06 Auxiliary Systems; 08 Communications; 09 Electronics; and 22 Navigation and Guidance.

N63-10013 Entwicklungsring Süd, Munich (W. Germany)
EIN BEITRAG ZUR MESSUNG VON ROLLDÄMPFUNGEN IM WINDKANAL [A CONTRIBUTION TO THE MEASUREMENT OF ROLL-DAMPING IN THE WIND TUNNEL]
E. Klinke and A. Müller [1962] 6 p In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-12, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 15) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

The dependence of the rolling moment on flight motion and rudder deflection has been studied in the wind tunnel of the advanced technical school at Munich. The order of testing is described, the details of model construction are given, and the validity of measurements and evaluation is reviewed. The paper is illustrated with drawings of the model and its driving mechanism, the positions tested, and also gives curves which were plotted from the values obtained from the various tests. A.S.

N63-10041 Deutsche Forschungsanstalt für Luft- und Raumfahrt. Inst. für Luftfahrzeugführung, Brunswick (W. Germany)
PROBLEME DER FLUGMESSTECHNIK IN KLEINFLUGKÖRPERN [PROBLEMS IN FLIGHT MEASUREMENT TECHNIQUES IN SMALL FLYING BODIES]
A. Becker 1962 19 p In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-11, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 45) Available from WGL, Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

In flight measurement techniques, two major divisions may be differentiated. The first of these is the earthbound process which employs radar, kinotheodolites, and similar instruments. This process predominates in applications for the ascertainment of lines of flight, flight paths, and trajectories. The second division includes measuring devices aboard a flying body. These detect physical events of interest and are adaptable to transmission, information indication, and data storage. Instruments for small vehicles provide a special problem due to space limitations. This paper describes various instruments for use in small vehicles and is illustrated with drawings and photographs of the instruments. A full-sized record produced by such equipment is included. A.S.

N63-10077 Joint Publications Research Service, Washington, D.C.
SOVIET PATENTS ON ACOUSTICAL AND MAGNETIC MEASURING INSTRUMENTS
A. Ya. Rotshteyn et al Nov. 13, 1962 206 p
(JPRS-16134) OTS: $14.00

Acoustical and magnetic measuring devices that have received Soviet patents between 1951 and 1961 are described. Drawings and circuit diagrams are included. R.C.M.

N63-10100 Boeing Scientific Research Labs., Seattle, Wash.
PROPOSAL OF A NEW METHOD FOR THE PRECISION MEASUREMENT OF FRACTIONAL BIREFRINGENCE IN PHOTOELASTICITY
Y. F. Cheng Apr. 1962 10 p 3 refs
(DI-82-0165)

A new method is presented for the precision measurement of fractional birefringence in photoelasticity by either the transmitted or scattered light techniques. Both techniques use the same arrangement of optical elements and require no apparatus other than the standard polariscope. R.C.M.

N63-10128 RCA Victor Co., Ltd. Research Labs., Montreal (Canada)
SOLID STATE CHARGED PARTICLE SILICON DETECTORS Final Technical Report [June 1, 1961-May 31, 1962]
J. W. Hallam and R. L. Williams Wright-Patterson AFB, Ohio, Aeronautical Research Labs., Aug. 1962 20 p 3 refs
(Contract AF 33(616)-8373)
(ARL-62-406)

The research carried out under this contract deals with the lithium ion drift method of making wide depletion layer Solid State Nuclear Particle Detectors. Lithium ions, drifting in the field of a reverse biased silicon diode at temperatures in the 100° to 140° C range, compensate to a high degree the original impurities of a pellet. With a suitably drifted unit, a voltage of 100 volts or less will extend with depletion layer completely across a compensated region a few millimeters deep. Author

N63-10131 Aro, Inc., Arnold Air Force Station, Tenn.
MICROWAVE MEASUREMENT OF PROJECTILE KINEMATICS WITHIN LAUNCHER BARRELS
R. E. Hendrix Arnold Engineering Development Center, Nov. 1962 36 p 6 refs
(Contract AF 40(600)-1000)
(AEDC-TDR-62-213)

Microwave reflectometry has been applied successfully to the study of the kinematic behavior of projectiles within launcher barrels and pistons within compression (pump) tubes in the Hypervelocity Pilot Range of the von Kármán Gas Dynamics Facility. Well-defined mathematical treatment enables the calculation of an accurate time history of projectile position inside its launcher barrel. Microwave excitation in extraneous modes has been attenuated, resulting in an increase in the accuracy of the reflectometer system. Author

N63-10136 Air Force Cambridge Research Labs., Electronics Research Directorate, Bedford, Mass.
THE HYDROMAGNETIC WAVE TUBE: THEORETICAL INVESTIGATION OF MODE STRUCTURES Research Report
D. J. DeCourcy, Jr., and M. H. Bruce Aug. 1962 113 p 7 refs
(AFCRL-62-550)

Instrumentation has been designed and constructed to allow experimental investigation of ionospheric motions. This device is called the Hydromagnetic Wave Tube. The principal purpose of this report is to theoretically determine the basic modal patterns of the electric and magnetic fields under operating conditions and to determine the propagation characteristics of these fields as functions of the static magnetic field, the ionization concentration, and the frequency of the perturbing source. Brief outlines of the overall project and the physical construction of the Hydromagnetic Wave Tube are also included. Author

N63-10176 National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APPLICATION OF THE MODULARIZATION CONCEPT TO SATELLITE TAPE RECORDERS
P. T. Cole, H. J. Peake, and C. F. Rice Washington, NASA, Nov. 1962 15 p
(NASA TN D-1451) OTS: $0.50

A program is underway at Goddard Space Flight Center to adapt the widely accepted concept of modularization to magnetic tape recorders for satellite application. Prior to this program, special recorders were custom-designed for the particular requirements at hand. Even long lead times often were insufficient for development of good designs with assurance of reasonable reliability. Reduction of recorders to discrete mechanical modules offered an attractive solution to this problem. Slight design variations in modules would then make possible a series of recorders to operate at different speeds, operate over different frequency ranges, and perform different functions. This modularization concept is being applied in the design and development of the recorder for the United Kingdom No. 2 satellite with considerable success. Author

N63-10183 Indiana U. Div. of Optometry, Bloomington

CALIBRATION OF THE INFRARED OPTOMETER Technical Documentary Report [May 1, 1961-Mar. 31, 1962]

Merrill J. Allen Wright-Patterson AFB, Ohio, Life Support Systems Lab., Aug. 1962 17 p 1 ref
(Contract AF 33(616)-6146)
(AMRL-TDR-62-88) OTS: $0.50

A modification is described for calibrating the infrared optometer for an individual subject without using trial lenses or a subjective optometer. Author

N63-10204 National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SCANNING MECHANISM FOR A SATELLITE BORNE X-RAY SPECTROMETER

Gerald L. Hempfling Washington, NASA, Nov. 1962 17 p
(NASA TN D-1097) OTS: $0.50

The design and testing of a scanning mechanism of an X-ray spectrometer is documented. This device also maintains the detector perpendicular to the radiation beam incident from the grating, as the detector moves along the focal curve. The information presented in this report should be useful in the future designing of similar devices, particularly when the detector is required to remain perpendicular to the incident rays. Author

N63-10208 Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex.

MINIATURE ELECTROSTATIC VIDICON CAMERA

Thomas A. Gunn Oct. 1962 32 p
(SELWS-E-104)

A miniature lightweight vidicon television camera has been developed for closed-circuit television systems. The camera, including vidicon and control circuitry, employs only 54 transistors instead of the usual 107. The self-contained system requires only AC line voltage and a television monitor for complete operation. The picture quality and resolution are similar to commercially available models but greatly improved because of the unique method of electrostatic deflection and focus. This eliminates the complex magnetic yoke and circuitry required by conventional vidicon cameras. Author

N63-10213 Aberdeen Proving Ground. Ballistic Research Labs., Md.

THE DEVELOPMENT OF AN AERIAL CAMERA WITH CELESTIAL ORIENTATION

Donald F. Menne Aug. 1962 36 p 2 refs
(Partially supported by ARO(D) Funds)
(BRL-Memo-1425)

An aerial camera system which records an image of the sun or other celestial object simultaneously with a terrestrial photograph has been developed. The addition of precise astronomical measurements serves to counteract the unfavorable accumulation of errors in the determination of orientation parameters for extended aerial triangulations. The camera has two 100-mm focal length, f/5.6 lenses incorporated in a camera body in such a way that the respective fields of view are diametrically opposed. A pulse operated shutter system provides synchronization of exposures within .001 second for exposure durations of 0.010, 0.005, 0.003 or 0.002 second. The occurrence of exposure is determined to 0.050 second as part of the astronomical measurements. Author

N63-10279 Aerospace Information Div., Library of Congress, Washington, D.C.

SOVIET RECOMPUTATION OF THE LATERAL PHOTOVOLTAIC EFFECT

Nov. 8, 1962 3 p Review of: I. I. Taubkin and A. I. Frimer On the calculation of the lateral photoeffect photocell Radiotakh. i Elektron. (Moscow), v. 7, no. 7, 1962 p 1196-1205; J.T. Wallmark Photocell measures light direction Electronics, v. 30, no. 7, July 1, 1957 p 165-167; and G. Lucovsky Photoeffects in nonuniformly irradiated p-n junctions J. Appl. Phys., v. 31, no. 6, June 1960 p 1089-1095
(AID-62-184) OTS: $1.10 ph, $0.80 mf

Taubkin and Frimer challenge Wallmark's approximation of the lateral photovoltaic effect and present a more rigorous theoretical explanation which incorporates the lateral fall-off parameter introduced by Lucovsky. Computations are given for both small and large signals which show that the linearity of the response holds only for very low illumination. R.C.M.

N63-10284 Johns Hopkins U. Carlyle Barton Lab., Baltimore, Md.

A NONLINEAR FILTER FOR IMPROVEMENT OF SIGNAL DETECTABILITY IN THE PRESENCE OF NON-GAUSSIAN NOISE

Robert H. Richard Oct. 1962 114 p 14 refs
(Contract AF 33(616)-6753)
(AF-98)

A nonlinear filter is investigated, and its effectiveness in improving signal detectability in the presence of certain types of non-Gaussian noise is determined. The filter consists of a zero-memory nonlinear device followed by a low-pass filter, the nonlinear device being designed on the basis of only the first-order statistics of the interfering noise and of the sum of signal and noise. The results indicate that, when the noise probability density function is sufficiently different from Gaussian, a considerable improvement in detection reliability can be obtained. When the noise is Gaussian, the filter reduces to a linear one. Author

N63-10290 Union Carbide Nuclear Co., Oak Ridge, Tenn.

DOSIMETRY BADGE ORIENTATION EXPERIMENT

J. W. Redmond Nov. 12, 1962 27 p 3 refs
(Contract W-7405-eng-26)
(Y-1405) OTS: $0.50

Dosimetry experiments were conducted to evaluate the orientation capabilities of neutron-activated materials when located around the necks of radiation-equivalent manikins exposed to nuclear excursions from uranium metal and solution sources. Neckpieces were made containing gold, sulfur, or copper. Orientation within forty-five degrees was determinable with either gold or sulfur neckpieces at neutron doses above twenty-five rads. The copper did not provide as sensitive a direction measurement, probably due to backscatter of neutrons from the body. Author

N63-10291 Oak Ridge Technical Enterprises Corp., Tenn.

EFFECTS OF LONG TERM VACUUM ON COMMERCIAL SILICON RADIATION DETECTORS [Final Technical Documentary Report Oct. 1, 1961-May 24, 1962]

W. L. Weiss and E. M. Whatley Wright-Patterson AFB, Ohio, Aeronautical Research Labs., Aug. 1962 145 p 43 refs
(Contract AF 33(616)-8397)
(ARL-62-416) OTS: $2.75

The data presented are a graphical representation describing the effects of long term vacuum ($\sim 10^{-6}$mm Hg for 6 months) on commercially available silicon radiation detectors of two types: surface barrier, which are manufactured from n-type single crystal silicon and diffused junction, which are manufactured from p-type single crystal silicon. Data include measurements of alpha resolution, dead layer or window thickness, RMS noise voltage, reverse leakage current and pulse height stability at rated voltage. The report includes a summary of radiation damage on semiconductor materials and devices. Author

N63-10316 Naval Radiological Defense Lab., San Francisco, Calif.

A METHOD OF INCREMENTAL RECORDING ON MAGNETIC TAPE

L. A. Perrine and H. Z. Zagorites Feb. 12, 1962 22 p 2 refs (USNRDL-TR-548)

A simple method of incremental recording is described wherein the tape is stepped one increment of length for each serial input pulse, allowing optimum bit packing which is independent of pulse rate. The method is applicable to multichannel recording of variable pulse rates up to 100 pps and to recording mediums other than magnetic tape. It is advantageous where low power drain and long recording time without tape reloading are required. An experimental miniature incremental magnetic tape recorder, utilizing a commercially available stepping motor and having transistorized logic and drive circuitry is described. Test results are given and a method of data analysis for incrementally recorded tape by means of conventional playback is presented. Author

N63-10343 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

PRINCIPLES OF THE THEORY OF MAGNETOTELLURIC PROFILING

M. N. Berdichevskiy Sept. 21, 1962 31 p 13 refs Transl. from Priklad. Geofiz. (Moscow), no. 28, 1960 p 70-91 (FTD-TT-62-1062/1+2+4)

The theory of magnetotelluric profiling is discussed for its application to surveying geologic structures. The magnetotelluric field is the aggregate of plane-homogeneous multiharmonic electromagnetic waves propagated along the z-axis in an n-bed horizontal-homogeneous medium. Formulas are presented for determining the total longitudinal conductivity S of a strata covering a high-resistance base. Measurements are made with a device consisting of two electrical (E_x, E_y) and two magnetic ($\dot{H}_x$, $\dot{H}_y$) channels. The depth of penetration of these measurements depends on the relative resistance in ohm/m between the strata of the earth's crust. R.C.M.

N63-10362 National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York, N.Y.

NUCLEAR INSTRUMENTATION IN SPACE: PART I—MISSIONS FOR NUCLEAR INSTRUMENTS

Alastair G. W. Cameron Repr. from NUCLEONICS, v. 20, no. 10, Oct. 1962 p 50-54

Space missions for nuclear instruments are discussed as follows: galactic cosmic rays; solar cosmic rays; high-energy gamma rays; low-energy gamma rays; trapped particles; interplanetary plasma; and the composition and abundances in space. R.C.M.

N63-10364 Joint Publications Research Service, Washington, D.C.

SOME IMPROVEMENTS IN THE GAK-2M GRAVIMETER

M. Ye. Abel'skiy Nov. 15, 1962 8 p Transl. from Razved. i Promysl. Geofiz. (Moscow), no 42, 1961 p 72-76 (JPRS-16197) OTS: $1.10

This article presents the basic improvements that have been made in the GAK-ZM gravimeter as a result of investigations in the gravimetric laboratory of the Len-branch of the VNIIG. Improvements include the following: fastening of the textolite cup to the panel and base of the body of the quartz system has been reinforced; eliminating the connection between the center part of the instrument and the outer shell; replacing the duralumin outer casing with a steel one and modifying the design of the bottom of the casing, etc. Field tests of the gravimeter show that the improvements in the various components of the instrument, the superior insulation, and the utilization of the full capacity of the thermal compensation device to achieve the fullest temperature compensation in the quartz system will ensure a high level of quality. J.R.C.

N63-10445 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

THE SPATIAL DISTRIBUTION OF THE VISIBILITY OF INTERFERENCES IN THE MICHELSON INTERFEROMETER

J. Bakos and K. Kantor Sept. 14, 1962 15 p 6 refs Transl. of "Die Raumliche Verteillung Der Sichtbarkeit Von Interferenzen Im Michelson Interferometer" Budapest, Hungarian Acad. of Sci., Central Res. Inst. for Phys., June 1962 12 p (FTD-TT-62-1178/1+2)

A short review is given on the experimental work in which the spatial distribution of the visibility is investigated in the Michelson interferometer in the case of a large light source. The purpose is to investigate the function of visibility v/P, Q, R/ on the spatial coordinates /P, Q, R/ of the observation point:

$$V(P, Q, R) = I_{max} - I_{min} / I_{max} + I_{min}$$

Author

N63-10482 Army Signal Missile Support Agency, White Sands Missile Range, N. Mex.

INVESTIGATION OF PULSE RECEIVERS IN RADAR BEACONS

Drew Dowling and C. R. Wise June 1962 26 p 5 refs (EID-119)

A mathematical model of a superheterodyne receiver that employs stagger tuning to give a maximally flat response is simulated on a digital computer. The model includes provision for varying the difference in frequency that may occur between the center frequency of the receiver and the frequency of the incoming signal. The response of this simulated receiver is analyzed for various bandwidth-pulsewidth products and different input pulse rise times. Author

N63-10512 Electro-Optical Systems, Inc., Pasadena, Calif.

COHERENT OPTICAL SURVEILLANCE DEVICES [Progress Report No. 2, May 19-Aug. 19, 1962]

Richard E. Bradbury Aug. 30, 1962 28 p (Contract AF 30(602)-2710) (EOS-2230-Q-2; RADC-TDR-62-420)

A gas cell phase shifter has been assembled and is undergoing preliminary tests. For the purpose of calibrating the phase shifter, a photomultiplier fringe detection system has been adapted to a Twyman-Green interferometer. Initial work has begun on the differential phase shift interferometer. Author

N63-10551 Illinois U. Coordinated Science Lab., Urbana

A PHOTO-CURRENT SUPPRESSOR GAUGE FOR THE MEASUREMENT OF VERY LOW PRESSURES

W. C. Schuemann Oct. 1962 13 p 4 refs (Contract DA-36-039-SC-85122) (Rept. R-156)

An ionization gauge has been designed which removes the low pressure limitation due to X-rays found in conventional ionization gauges while maintaining a comparable sensitivity. In this gauge, an additional electrode establishes an electric field which repels photoelectrons ejected from the ion collector. A similar photocurrent

from the suppressor grid is prevented by shielding this electrode from the X-rays. Preliminary experimental results have verified the suppression of photocurrents; pressures as low as 2×10^{-12} Torr have been measured. Author

N63-10562 Ohio State U. Research Foundation, Columbus
RECENT ADVANCES IN THE USE OF THE ELECTRON SPECTROMETER Scientific Report No. 4
Edwin N. Lassettre, Frederic M. Glaser, Vincent D. Meyer, and Ausma Skerbele Sept. 1962 27 p 19 refs
(Contract AF 19(604)-4541)
(AFCRL-62-1070)

The stability, resolution and electron beam current of the electron spectrometer have been increased. This has been accomplished by heating the entrance and exit slits of the velocity analyzer used for velocity selection before scattering, and by substituting a short slit (width is half the diameter of the pinhole) for the exit pinhole and entrance slit of the velocity analyzer. Excitation potentials and the relative intensities of peaks obtained by electron impact are discussed briefly and compared with optical data. Electron impact spectra of helium, nitrogen, nitric oxide, and carbon dioxide are included. Author

16 LIFE SCIENCES

Includes: biology; exobiology; physiology; medicine; life support systems; radiation effects on biological systems; and space sickness.

For related information see: 14 Human Behavior; and 28 Space Radiation.

N63-10052 Deutsche Versuchsanstalt für Luft- und Raumfahrt. Inst. für Raumfahrtforschung, Porz (W. Germany)
ERSTE ERGEBNISSE AN SIMULATIONSKAMMERN [FIRST RESULTS WITH SIMULATION CHAMBERS]
Manfred Janes [1962] 18 p 4 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-12, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 57) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

This discussion on simulation chambers deals with the following aspects: (1) description of degassification in (a) space, (b) a chamber without cooled walls, (c) a chamber with cooled walls; (2) course of the potential curves for chemical sorption and physical adsorption near the surface; (3) presentation of a large space simulation chamber; (4) cold diffusion pump; (5) pressure distribution at the areas in front of and behind the nozzle as a function of the discharge mass; (6) pressure on the inlet flange as a function of the size of the cooling surface; (7) pressure conditions as a function of the inlet mass of working gases; and (8) course of the pressure conditions as a function of the cooling surface. Trans. by I.V.L.

N63-10058 Deutsche Versuchsanstalt für Luft- und Raumfahrt. Inst. für Flugmedizin, Bad Godesberg (W. Germany)
ZUR BEURTEILUNG DER BIOLOGISCHEN LEISTUNGSRESERVE EINES PILOTEN [ON THE ESTIMATION OF THE BIOLOGICAL PERFORMANCE RESERVE OF A PILOT]
H. Brüner, D. Jovy, K. E. Klein, and S. Ruff [1962] 18 p In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-12, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 63) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

With present day advancements in aviation, questions arise as to how the future pilot would react to the lack of oxygen at altitudes of 3000 to 4000 meters. Previous testing methods are no longer suitable, for under certain circumstances, physiological and psychological demands may reach or exceed permissible boundaries. A series of tests were therefore devised and performed to determine capabilities and limitations. The tests and evaluations are described in this document. A.S.

N63-10059 Deutsche Versuchsanstalt für Luft- und Raumfahrt. Inst. für Flugmedizin, Bad Godesberg (W. Germany)
PHYSIOLOGISCHE HITZEPROBLEME DER RAUMFAHRT [PHYSIOLOGICAL HEAT PROBLEMS OF SPACE TRAVEL]
H. M. Wegmann, H. Brüner, D. Jovy, and K. E. Klein [1962] 14 p 15 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-12, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 64) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

A study of the physiological heat problems of space travel indicated that, in particular, two factors should be considered: one, a physical factor estimating the surrounding climate; the other, a physiological factor evaluating the biological effects of heat stress. It is considered that stress, resulting from climatic changes under conditions where the astronaut may be at rest or at work, is physiologically independent of time only as long as the rectal temperature of 38.3° C and a pulse frequency rate of 115/min are not exceeded. Results of this study emphasized the determination of climatic conditions which would permit a permanent stress without harmful effects to the astronaut. Also, criteria are presented for technical apparatus that is capable of regulating climatic conditions. Trans. by I.V.L.

N63-10060 Deutsche Versuchsanstalt für Luft- und Raumfahrt. Inst. für Flugmedizin, Bad Godesberg (W. Germany)
MÖGLICHKEITEN UND PROBLEME FÜR DEN BETRIEB VON QUASI VORRATS- UND NACHSCHUBFREIEN BIOLOGISCHEN VERSORGUNGSSYSTEMEN FÜR RAUMFAHRER [POSSIBILITIES AND PROBLEMS FOR THE OPERATION OF QUASI RESERVE- AND SUPPLY-FREE BIOLOGICAL SUPPORT SYSTEMS FOR SPACE TRAVELERS]
Wolfgang Briegleb [1962] 7 p 24 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-12, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 65) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

This paper surveys some of the organisms found in nature and studies the manner in which these organisms maintain their self-sufficiency without too much dependence upon supply sources. It is possible that analogous processes suitable for humans will be developed so as to permit space travelers to conduct extensive voyages into space. Examples are given of insects that carry and breed bacteria within their own bodies, permitting a synthesis and supply of vitamins; termites which fulfill their albumen needs by means of fungi cultures which they carry; waste-scavengers which obtain water from their own metabolic processes; and water salamanders which supply the oxygen needs of their eggs by attaching them to leaves which produce large quantities of oxygen. The animal process of hibernation is also being studied. A.S.

N63-10061 Max-Planck-Institut für Arbeitsphysiologie, Dortmund (W. Germany)
BIODYNAMISCHE PROBLEME DER LUFT- UND RAUMFAHRT [BIODYNAMIC PROBLEMS OF AIR- AND SPACE-TRAVEL]

Rolf Coermann [1962] 45 p 14 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 66) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

Biodynamic problems, which will arise with the development of space vehicles of the future, are discussed. Physiological sound dynamics offer necessary references for the development of auditory protective devices. Respiratory system dynamics are of great significance not only in the development of respiratory-facilitating devices, but also for development of devices to protect from explosion-shock waves. Tolerance of impact is a limiting factor for catapult seats, parachutes, and other landing devices. These are only a few of the obvious examples that demonstrate the intertwining of biodynamics with the (space exploration) technique. A.S.

N63-10151 Armour Research Foundation, Chicago, Ill.
ENZYMATIC DIGESTION OF ALGAL CELLS [Final Report, Mar. 1, 1961-Apr. 30, 1962]
Maurice E. King and Alan M. Shefner Wright-Patterson AFB, Ohio, Biomedical Lab., Aug. 1962 15 p 16 refs
(Contract AF 33(616)-7964)
(ARF-3193-5; AMRL-TDR-62-91) OTS: $0.50

Various enzymes were investigated in an effort to develop an enzyme supplement that would increase the nutritive value of an algal ration. Such an enzyme additive would function by directly degrading the algal cells or by making the cells more susceptible to the action of the normal digestive enzymes. Enzymes were evaluated by in vitro digestion for 2 hours in artificial gastric juice followed by digestion for 4 hours in artificial intestinal juice. The commercial cellulases were not effective. Favorable results were obtained with enzyme systems derived from the snail *Helix pomatia* and the mold *Myrothecium verrucaria*. Pectinase was also effective, both alone and in combination with the snail and the mold enzymes. Author

N63-10152 RCA Service Co., Inc., Camden, N. J.
TECHNIQUES OF PHYSIOLOGICAL MONITORING. VOLUME I. FUNDAMENTALS [Final Report]
Miles A. McLennan Wright-Patterson AFB, Ohio, Biomedical Lab., Sept. 1962 131 p 69 refs
(Contract AF 33(616)-7750)
(AMRL-TDR-62-98(I)) OTS: $2.75

This volume is the first of a three-volume handbook covering the applications of electronics in monitoring bioelectric physiological responses. The fundamental concepts and methods presented in this volume form a foundation for the detailed technical discussions in the succeeding volumes and, it is hoped, provide a common language and basis of understanding between the physiologist and electronic engineer engaged in this field. The data obtained by monitoring physiological responses in varied environments can be used to improve the efficiency and increase the safety of a human subject in aircraft and spacecraft. Author

N63-10186 Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio
DETERMINATION OF 1,1-DIMETHYLHYDRAZINE (UDMH) IN URINE [Final] Technical Documentary Report [Oct. 1960-July 1962]
Philip Diamond and Anthony A. Thomas Biomedical Lab., Oct. 1962 14 p 10 refs
(AMRL-TDR-62-119) OTS: $0.50

The colorimetric determination of 1,1-dimethylhydrazine (UDMH) in urine using trisodium pentacyanoamino ferroate (TPF) has heretofore been hampered by interfering substances in urine which resulted in poor recovery and some false negative results. A procedure was developed which overcame this difficulty and was primarily designed to determine rapidly in an emergency situation the urinary concentration of UDMH in exposed personnel. The procedure involves a hydrogen peroxide treatment of the urine followed by a colorimetric complexing of UDMH with TPF. In vivo results are presented on dogs that received intraperitoneal doses of UDMH with urinary concentrations of UDMH being determined in spontaneously voided and 24-hour pooled specimens. The results give some indication of the relationship of dose to excretion levels. In vitro recovery in 100 human urine specimens is presented. Author

N63-10187 Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio
ULTRA MICRO PROCEDURE FOR UDMH IN BLOOD [Final] Technical Documentary Report [Sept.-Dec. 1961]
Mildred K. Pinkerton and Anthony A. Thomas Biomedical Lab., Oct. 1962 8 p 1 ref
(AMRL-TDR-62-120) OTS: $0.50

An ultramicroprocedure for the determination of 1,1-dimethylhydrazine (UDMH) in blood is described. The method uses 25 microliters of serum or plasma which can be collected as capillary blood in microhematocrit tubes and does not require deproteinization. The color reaction between UDMH and trisodium pentacyanoamino ferroate (TPF) occurs after direct treatment of the serum sample. The selection of normal commercially available control serum as a suitable blank is also discussed. Author

N63-10192 Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa.
REVERSIBLE FREE RADICAL GENERATION IN THE MELANIN GRANULES OF THE EYE BY VISIBLE LIGHT
Freeman W. Cope, Raymond J. Sever, and B. David Polis Oct. 9, 1962 22 p 20 refs
(NADC-MA-6212; BuMed Rept. 18)

By electron spin resonance measurements, the melanin granules of the mammalian eye have been shown to generate free radicals when irradiated with visible light under approximate physiological conditions. The generation in the light and decay in the dark of the free radicals takes place over a period of seconds. The equilibrium concentration of free radicals in light or dark is dependent on the concentration of water, hydrogen ions, and dissolved oxygen in the surrounding solution. The anatomical proximity of the melanin granules to the rods and cones and their response to light suggests that the melanin granules may play an important role in the visual process. Author

N63-10193 Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa.
CHRONIC DEFICITS OF TEMPERATURE REGULATION PRODUCED IN CATS BY PREOPTIC LESIONS
F. H. Jacobson and Russell D. Squires Oct. 12, 1962 32 p 13 refs
(NADC-MA-6213; BuMed Rept. 27)

Electrolytic destruction of the dorsomedial preoptic region abolished effective temperature regulation in 11 cats until the animals died or were sacrificed. Seven of these survived eight days or fewer. The remaining four plus two surviving cats were tested 26 to 206 days after operation. All had colonic temperatures significantly lower and more variable than the temperature of 12 unoperated cats and five operated controls. Six ordinarily hypothermic animals were tested at extreme ambient temperatures and showed impairment in their responses to both heat and cold, as indicated by colonic temperature measurements. One cat regained the ability to resist cooling but not heating. Two cats with anterior hypothalmic lesions, one with lateral lesions in the preoptic region, and two with medial lesions rostral to the preoptic region were unimpaired in their ability to regulate at normal or extreme ambient temperatures. Author

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N63-10239

SPACE MEDICINE AND ASTRONAUT SELECTION

A. D. Schwichtenberg *In* Virginia Polytechnic Inst., Blacksburg. Reentry Dynamics, Part II. Proc. of the Conf. on Physics of the Solar System and Reentry Dynamics, July 31 to Aug. 11, 1961 p 234-275 (See N63-10230 01-01) VPI: $2.00

This paper on space medicine and astronaut selection for space flights covers the effects of the following: acceleration, heat, vibration, meteoroids, hypoxia and decompression, radiation, weightlessness, noise, illumination, cabin environment and atmospheres, and physical and mental requirements of astronauts. J.R.C.

N63-10283 Battelle Memorial Inst., Columbus, Ohio

RESEARCH ON THE ELECTROLYSIS OF WATER WITH A HYDROGEN-DIFFUSION CATHODE TO BE USED IN A ROTATING CELL [Final] Technical Documentary Report [June 1, 1961-May 31, 1962]

John Clifford and Charles Faust Wright-Patterson AFB, Ohio, Life Support Systems Lab., Aug. 1962 66 p 34 refs
(Contract AF 33(616)-8431)
(AMRL-TDR-62-94) OTS: $1.75

This study has shown that the concept of a hydrogen-diffusion cathode is technically feasible for use in a water-electrolysis cell for production of breathing oxygen under weightlessness. A cathode current density of 265 amp/ft² at a cell voltage of 1.76 v performed best while maintaining 100% transmission of hydrogen through a cathode of palladium-silver alloy foil for about 1 hr. Experiments with a stationary cell showed the importance of designing for minimum electrolyte contamination and the need for further study of activation of the cathode foil. To supply breathing oxygen for 3 men, preliminary design indicated the need for a rotating electrolysis cell. Author

N63-10306 Air Force Systems Command Foreign Technology Div., Wright-Patterson AFB, Ohio

EFFECT OF LIGHTING CONDITIONS ON THE CONVERSION OF GREEN PIGMENTS

O. G. Sudyna and K. P. Dovbish Sept. 19, 1962 18 p 17 refs Transl. from Ukrainskiy Botan. Zh., v. 19, no. 3, 1962 p 10-19
(FTD-TT-62-1203/1+2)

The effect of lighting conditions on the conversion of green pigments in wheat shoots was studied in an effort to determine the process of chlorophyll biosynthesis. Chromatographic and spectrophotometric methods were used to identify the green porphyrin pigments chlorophyll, chlorophyllide, protochlorophyllide, and protochlorophyll from plants under various lighting conditions. In etiolated wheat shoots, the porphyrin pigment accumulated is mainly protochlorophyllide, while in green wheat shoots placed in darkness after a day or more in light, the predominant phytol-free porphyrin pigment is chlorophyllide. Previous illumination of wheat shoots does not affect the ability of the plants to regenerate protochlorophyllide into chlorophyllide under dark conditions. These investigations support the idea that the final stages of chlorophyll biosynthesis take place in the protochlorophyllide to chlorophyllide to chlorophyll sequence. M.P.G.

N63-10308 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

THE EFFECT OF COSMIC RADIATION ON PLANT ACTIVITY

A. A. Shakhov Oct. 11, 1962 21 p 17 refs Transl. from Zh. Obshch. Biol., v. 23, no. 2, 1962 p 81-89
(FTD-TT-62-771/1+2+4)

The effects of ultraviolet and infrared irradiation on plant physiology and photosynthesis are studied to determine the capability of plants to adapt to space environment. The reflection, transmission, and absorption of radiant energy by leaves were determined for several generations of plants at altitudes of 4000 to 5000 meters above sea level. Artificial sources of ultraviolet radiation were used on some of the plants. While some plants, such as Parallelum barley, show only a slight increase in photoabsorption after seven generations, others showed a marked increase during the first planting. Photographs taken with the electron microscope show definite changes in the chloroplasts of leaves exposed to increased ultraviolet irradiation. These changes were not found to be pathogenic as the photosynthesis process did not decrease. It is concluded that plants can adapt favorably to the radiations found in space. R.C.M.

N63-10322 Pennsylvania U. Schools of Medicine, Philadelphia, Pa.

EFFECTS OF CHANGES IN BLOOD P_{CO_2} ON BRAIN OXYGENATION AT 147 MM. HG AMBIENT PRESSURE (39,000 FEET)

E. C. Pierce, Jr., C. J. Lambertsen, M. J. Strong, S. C. Alexander, and D. Steele Brooks AFB, Tex., School of Aerospace Medicine, June 1962 20 p 51 refs
(Contract AF 41(657)-16)
(SAM-TDR-62-70)

Hyperventilation during the breathing of 100 percent oxygen elevates the P_{O_2} of alveolar gas by the same amount that it lowers its P_{CO_2}. Since the development of arterial hypocapnia causes cerebral vasoconstriction, brain oxygenation is drastically decreased even while arterial oxygenation is improved by the hyperventilation. Administration of 30 percent CO_2 with oxygen at an ambient pressure equivalent to that at 39,000 feet altitude prevented alkalemia and, in spite of hyperventilation, restored central oxygenation to a level at least equivalent to that found when pure oxygen was breathed at rest at the same altitude. The respiratory minute volume during administration of CO_2 with O_2 was greater than when O_2 alone was breathed at the reduced ambient pressure. Since neither arterial P_{O_2} nor central P_{CO_2} values differed in these two experimental situations, the respiratory stimulation may represent the quantitative demonstration in man of a respiratory effect of carbon dioxide which is mediated solely by the chemoreceptors exposed to arterial blood, and which acts in the absence of a change in direct central stimulation by CO_2. Author

N63-10337 Minneapolis-Honeywell Regulator Co. Aeronautical Div., Minn.

LIFE SUPPORT SYSTEMS EVALUATOR INSTRUMENTATION [Final] Technical Documentary Report [May 1962 - Feb. 1962]

E. E. Beson and M. P. Dickey Wright-Patterson AFB, Ohio, Life Support Systems Lab., Aug. 1962 58 p 4 refs
(Contract AF 33(616)-8349)
(MH-AERO-2662-TR2; AMRL-TDR-62-90) OTS: $1.50

The Life Support Systems Evaluator Console was built to monitor and record the changes in environmental parameters occurring during the test of men and life systems in an evaluator or space-flight test chamber. The problems involved in furnishing the necessary instrumentation and displays were considered in a preliminary design investigation. The system design which evolved from the preliminary study embodies a four-module steel enclosure or console, with turret top section, work-table surface, and rollaway table section, which contains the complete monitor system. The evaluator instrumentation includes sensors, indicators, and recorders which enable the investigators to monitor the following: absolute and differential pressures at six different stations in the test chamber, temperatures at 24 stations within the forward and aft sections of the chamber, relative humidity in forward and aft sections of the test chamber, analyses of chamber atmospheric composition, and continuous recording of the variables. Author

N63-10363 Joint Publications Research Service, Washington, D.C.
MEDICO-BIOLOGICAL CONTROL IN COSMIC FLIGHT
V. I. Yazdovskiy and R. M. Bayevskiy Nov. 15, 1962 14 p Transl. of article from Vestnik Akad Nauk SSSR (Moscow), no. 9, 1962 p 9-15
(JPRS-16205) OTS: $1.60

The biomedical instruments used in the Vostok-3 and -4 space vehicles are described along with their associated data transmission systems. The instruments consisted of an electrocardiograph, a pneumograph, an electroencephalograph, an electro-oculograph, and a skin galvanometer. The methods of processing the medical information are discussed for both on-board and on-the-ground systems. The general demands for future space flights are considered. R.C.M.

N63-10395 Acoustica Associates, Inc., Los Angeles, Calif.
ULTRASONICS—A NEW CONTROL FOR SPACE AND SUBMARINE BIOECOSYSTEMS AND ECOSUBSYSTEMS
E. B. See *In* Air Force Systems Command. Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif. Transactions of the 7th Symp. on Ballistic Missile and Space Technol., U.S. Air Force Academy, Colo., Aug. 13-16, 1962 Vol. II p 219-250 78 refs (See N63-10389 01-01)

New concepts, data, and a working theory are developed for the use of ultrasonic energy to accelerate and control prime subsystem mechanisms in a closed ecological system. Rate of dialysis, osmosis, solution, extraction, membrane transfer, gas and heat exchange, efficiency of electrolysis, and growth of plants can be controllably accelerated by ultrasonic irradiation. Ultrasonic energy should restore these rates should they be decreased due to zero gravity. Acoustic parameters are analyzed which were found effective for control of plant metabolism. Test equipment and a versatile plant-growth test machine are shown. Miniaturized ecosubsystems with controllable output will result from effective use of ultrasound. Author

N63-10396 Dynamic Science Corp. Medical Sciences Dept., S. Pasadena, Calif.
SOME CONSIDERATIONS ON THE PROBLEM OF VESTIBULAR DISTURBANCES PRODUCED IN A ROTATING ENVIRONMENT
C. E. Miller *In* Air Force Systems Command. Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif. Transactions of the 7th Symp. on Ballistic Missile and Space Technol., U.S. Air Force Academy, Colo., Aug. 13-16, 1962 Vol. II p 251-269 10 refs (See N63-10389 01-01)

The problem of the stimulation of the semicircular canals of the inner ear by head movements made in a rotating environment is discussed, particularly insofar as it relates to a rotating space station. A review of all the rotation devices which might be used for space station simulation shows that *c ll* fail to simulate at least one important variable, the magnitude and direction of the resultant gravity vector. It is suggested that properly made studies at gravity levels greater than one g may be useful in evaluating the problem for gravity levels less than one g. If it can be shown that the vestibular disturbances are a function of the gravity level present, such information would be of importance in space station design. Author

N63-10433 Ohio Tuberculosis Hospital, Columbus
MECHANISMS OF HYPERVENTILATION IN MAN. [PART I] CARBON DIOXIDE AND ACID-BASE TRANSIENTS DURING HYPERVENTILATION. [PART II] RECOVERY FROM ACUTE HYPERVENTILATION
Joseph F. Tomashefski, Earl T. Carter, and Joseph A. Lipsky (Ohio State U. Coll. of Medicine, Columbus) Brooks AFB, Tex., School of Aerospace Medicine, June 1962 34 p 41 refs
(SAM-62-52; SAM-62-53)

Studies were conducted on ten healthy adult males subjected to mechanically induced hyperventilation. Total ventilation was increased approximately 300 percent. This resulted in a mean arterial carbon dioxide tension decrease to 20 mm. Hg and a mean pH increase to 7.60. Observations of the dynamic shifts in carbon dioxide stores were made for a 12-minute period after the onset of hyperventilation. The total carbon dioxide elimination was determined and compared to the basic metabolic CO_2 production to permit estimation of body carbon dioxide depletion. The total carbon dioxide elimination was partitioned into that coming from the tissues, the blood, the lung parenchyma, and the alveolar air. After the abrupt increase in alveolar ventilation, a significant portion of the expired carbon dioxide comes from the lung-tissue store and the alveolar-gas compartments; this is approximately 140 cc. and is eliminated in the first three minutes. After three minutes, most of the expired carbon dioxide can be accounted for as coming from blood and tissues. Author

N63-10451 Batelle Memorial Inst., Columbus, Ohio
AN EVALUATION OF HIGH-PRESSURE OXYGEN SYSTEMS [Final Report, May 1, 1961-June 30, 1962]
J. V. Baum, B. Goobich, and T. M. Trainer. Wright-Patterson AFB, Ohio, Life Support Systems Lab., Sept. 1962 90 p refs (Contract AF 33(616)-8267)
(AMRL-TDR-62-102) OTS: $2.25

The safety of 7500-psi gaseous oxygen systems used as a source of breathing oxygen in aerospace vehicles was studied. These effects were studied: temperature, vibration, shock, extended storage, contamination, high pressure, high-velocity flow, and heating due to rapid compression. Results indicate that 7500-psi oxygen systems can be safe if proper precautions are taken. Stainless steel and Monel alloys were acceptable as construction materials. Teflon and Kel-F compounds were suitable for seals. Hydrocarbons in minute concentrations were found not to be dangerously reactive. Electrostatic charges due to high-velocity flow were small. Erosion could be a serious problem. No appreciable chemical reactions occurred during the program; 7500-psi oxygen systems must be treated as "new" and representing explosive possibilities. The combustion process should be studied further. Self-ignition temperatures for the materials and contaminants considered in this research should be investigated under static and dynamic conditions. Before these systems can be used extensively, reliability of the system and equipment used for handling the gas should be increased. Author

N63-10467 Royal Aircraft Establishment, Farnborough (Gt. Brit.)
THE ANISOTROPY OF THE SKIN IN RESPECT OF THERMAL CONDUCTIVITY (DIE ANISOTROPIE DER HAUT FUER DEN WAERMETRANSPORT)
J. Aschoff and R. Wever London, Ministry of Aviation, Aug. 1962 7 p 8 refs Transl. by B. F. Toms from Arch. Ges. Physiol. (Berlin), 269(1959) p 130-134
(RAE Library Translation 1011)

By inserting heat sources and thermocouples into the skin the coefficients of thermal conductivity parallel to the surface of the skin in distal and proximal directions have been measured on the index fingers of various subjects. Both these thermal conductivity coefficients in general increase to a very marked degree as the blood flow through the skin (simultaneously recorded) increases. Thus the skin is highly anisotropic with respect to the coefficient of thermal conductivity. This anisotropy varies from person to person in magnitude and even in direction. Author

N63-10468 Callery Chemical Co., Pa.
RESEARCH ON TOXIC HAZARDS OF PENTABORANE [Final Report, Dec. 1960 - Dec. 1961]
George Roush, Jr., Bartis M. Kent, and Herbert A. Volz Wright-Patterson AFB, Ohio, 6570th Aerospace Medical Research Labs., Sept. 1962 40 p 11 refs
(Contract AF 33(616)-7728)
(AMRL-TDR-62-109) OTS: $1.25

At a plant producing pentaborane, sixty workers were exposed to the boranes. The purpose of this investigation was to measure these workers' exposure with the Blood Borane Test of Miller, to measure the contamination of the worker's environment, and to relate the data to observed biologic effects in the workers. The atmospheric monitoring revealed that the work area was usually not contaminated. Thirty-one cases of possible borane poisoning were seen. The Blood Borane Test was negative in each of these cases but these results may be due to the mild nature of the poisonings. The lung, liver, and kidney studies used revealed no abnormalities in these cases. A clinical evaluation on all of the exposed workers at the end of a year's production revealed no observable effects. The protective gear worn provided good, though not complete, protection. Author

N63-10469 Melpar, Inc., Falls Church, Va.

STUDY OF THE INTERMEDIARY METABOLIC PATHWAYS OF 1,1-DIMETHYL-HYDRAZINE (UDMH) [Final Report, July 1961-1962]

M. A. Mitz, F. L. Aldrich, and B. M. Vasta Wright-Patterson AFB, Ohio, 6570th Aerospace Medical Research Labs., Sept. 1962 27 p 9 refs

(Contract AF 33(616)-8455)

(AMRL-TDR-62-110)

The metabolic fate of 1,1-dimethylhydrazine (UDMH) was studied in female rats and dogs. The animals were given intraperitoneal injections of C^{14} labelled UDMH and, after an appropriate time, body tissues were examined by paper chromatography. Six compounds were found, although not all appeared in every tissue. Three major compounds were present in urine. Identification showed one (3-10%) to be the glucose hydrazone of UDMH, and another appeared to be unreacted UDMH (50-60%). The structure of the third major component (20-25%) was not determined, although its chemical and chromatographic behavior suggested that it was a hydrazone or hydrazide of a compound of higher molecular weight than acetic or pyruvic acid. Various analytical procedures were employed for the determination of UDMH in urine, and the trisodium pentacyanoaminoferroate (TPF) procedure was found to be the most sensitive and most specific qualitative method of those tested. Author

N63-10472 Chicago Medical School, Ill.

INTERNAL BODY MOVEMENTS RESULTING FROM EXTERNALLY APPLIED SINUSOIDAL FORCES [Final Report, Mar. 1960-Dec. 1961]

John L. Nickerson and Rold R. Coermann Wright-Patterson AFB, Ohio, 6570th Aerospace Medical Research Labs., July 1962 23 p 14 refs

(Contract AF 33(616)-7053)

(AMRL-TDR-62-81)

This report contains a description of an X-ray device designed to permit the observation of the movement of internal structures in the animal body subjected to sinusoidal oscillations. From the X-rays taken by this device, it has been possible to determine the resonance frequency and phase shift of regions within the abdomen and thorax set in motion by external oscillatory forces. The results of observations made on anesthetized dogs show that the visceral content of the abdomen and thorax appears to oscillate as a mass having a resonant frequency of 3 to 5 cycles per second and with damping of one-fifth to one-quarter of the critical value. Author

N63-10524 Federal Aviation Agency. Civil Aeromedical Research Inst., Oklahoma City, Okla.

MANIPULATION OF AROUSAL AND ITS EFFECTS ON HUMAN VESTIBULAR NYSTAGMUS INDUCED BY CALORIC IRRIGATION AND ANGULAR ACCELERATIONS

William E. Collins Oct. 1962 14 p 37 refs Presented at the annual meeting of the Aerospace Medical Association, Atlantic City, Apr. 9, 1962

(CARI Rept. 62-17)

Investigations concerned with the effects of subjective states on vestibular nystagmus were reviewed. Methods of controlling such states were discussed. Data indicate that the significant factor in subject orientation is a state of arousal, defined in terms of mental activity. Continuous, concerted attending to a task yields a brisk, long-duration nystagmus. If responses to a task require less attention with repetition, or if subjects are not kept alert, a significant reduction in nystagmus output may occur. Knowledge of subjectives states is a prerequisite for proper evaluation of vestibular responses in theoretical formulations, in many clinical situations, and in ascertaining vestibular components associated with air- or space-vehicle maneuvers. Author

N63-10540 Joint Publications Research Service, Washington, D.C.

BERYLLIUM: TOXICOLOGY, CLINICAL ASPECT OF DISEASES, LABOR HYGIENE

Valentin Mikhaylovich Kozlov and Valentin Dmitriyevich Turovskiy Dec. 3, 1962 35 p 27 refs Transl. of parts of the book "Berilliy: Toksikologiya, Klinika Porazheniy, Gigiyena Truda" Moscow, State Publishing House for Literature in the Field of Atomic Science and Technology, 1962

(JPRS-16496) OTS: $3.60

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N63-10547 Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.

ULTRAMICRO METHODS IN BIOCHEMISTRY: I. GENERAL CONSIDERATIONS. II. PROCEDURES FOR THE DETERMINATION OF SERUM BILIRUBIN

E. Van Stewart, Charles R. Puckett, and Agnes Wood Oct. 1962 33 p 22 refs

(Contract AT(29-2)-1013)

(LF-3)

A battery of biochemical tests to survey the function of body organs and systems of animals under a variety of experimental circumstances was selected. The choice of procedures was guided by an analytical concept, often employed clinically, to reveal early failure of the integrative mechanisms responsible for maintaining homeostasis. More specifically, the methods were chosen to assess general metabolism; to reveal general tissue destruction; and to provide selected data concerning adrenal, thyroid, and liver function as well as the status of liver, kidney, and bone. The need for serial sampling necessitated the development of an ultramicro system to allow numerous determinations on a small sample of blood. The Sanz ultramicro system was evaluated, and various aspects of the associated instrumentation are described and considered. Ultramicro procedures for determining serum bilirubin utilizing both the diazo reaction and spectrophotometric analysis were investigated. The preparation of a bilirubin standard in aqueous protein solution was developed and evaluated for stability and reproducibility. The relevant diazo coupling and spectrophotometric procedures are described, and results comparing the two analytical principles are recorded. Various necessary precautions applicable to these methods are set forth, and the advantages and disadvantages of each are detailed and discussed. Author

17 MACHINE ELEMENTS AND PROCESSES

Includes: bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; and materials fabrication, handling, and inspection.

For related information see: 06 Auxiliary Systems.

N63-10055 Deutsche Versuchsanstalt für Luft- und Raumfahrt. Inst. für Werkstoff-Forschung, Aachen (W. Germany)

REIBKORROSION—EINE ÜBERSICHT [FRICTION CORROSION—A SURVEY]

F.-C. Althof and K. Gerischer [1962] 15 p 31 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-11, 1962

(Wissenschaftlichen Gesellschaft für Luftfahrt Paper. 60) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

The problems of friction corrosion and fretting oxidation are discussed to point out methods of control. Further research must be done on fretting corrosion in order to select appropriate measurement values. The influence of friction corrosion on dynamic behavior is dependent upon loading requirements. A.S.

N63-10056 Dornier-Werke G.m.b.H., Munich (W. Germany)

REGENEROSIONSUNTERSUCHUNGEN AN OBERFLÄCHEN IM ÜBERSCHALLGE-SCHWINDIGKEITSBEREICH BIS ZUR MACHZAHL 1,4 [RAIN EROSION INVESTIGATIONS ON SURFACES IN THE SUPERSONIC RANGE UP TO MACH NUMBER 1.4]

[1962] 12 p In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-12, 1962 (Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 61) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

To study the corrosive effects of rain on surfaces at supersonic speeds up to 1.4 Mach number, a device has been constructed to simulate the natural conditions of rain erosion. The equipment consists of a) a wind tunnel with a vertical test section in which the gravitational velocity and frictional force are synchronous with the time for rain spatter to corrode; b) a rocket shield to imitate natural conditions; c) a rotating arm with the test sample attached. To attain supersonic velocities around 1.4 Mach the single blade rotor was fashioned with a radius of 1.20 and a foxwedge profile. In addition to other factors, the temperature of the surface at the point of impact is critical in an analysis of rain erosion. For this purpose a nickel-chromium-nickel thermoelement is mounted so that the recording point lies about 1 to 2 mm away from the test surface. The temperature as a function of the velocity without rain was measured. By separating the temperature of the rain and the temperature increase of the rain in action it is hoped to be able to determine the temperature of the test surface. M.B.S.

N63-10084 Automation Industries Inc., Ultrasonic Div., Torrance, Calif.

DEVELOPMENT OF ULTRASONIC INSPECTION TECHNIQUES AND EQUIPMENT TO RESOLVE CORROSION CONDITION IN NAVY AIRCRAFT

Joe B. Ramsey [1962] 25 p

(Contract NOA(S) 59-0150; Sub-contracted by Douglas Aircraft Co., Inc., El Segundo, Calif.)

This report contains the results of investigations to develop ultrasonic inspection equipment and techniques for determining the corrosion condition in Navy aircraft. Off-the-shelf test instruments were evaluated to determine suitability for field tests. Factors which could affect tests were evaluated. Inspection techniques and equipment were developed for use in detecting and evaluating corrosion. Equipment and techniques were recommended for use in field tests. Author

N63-10096 Mechanical Technology, Inc., Latham, N.Y.

BEARING MATERIALS FOR PROCESS FLUID LUBRICANTS Progress Report

M. B. Peterson Sept. 11, 1962 41 p 53 refs

(Contract Nonr-3731(00)(FBM))

(MTI-62TR20)

Materials are being evaluated for use in bearings that can be lubricated with steam or water. Alloys of aluminum, cobalt, copper, tantalum, nickel, titanium, zirconium, iron, gold, silver, and platinum have been compared for the following characteristics: solubility, formation of soft oxide films, crystal structure, melting temperature, recrystallization temperature, thermal conductivity, and hardness. As a result of this evaluation, the alloys of cobalt, copper, platinum, and gold have been selected for further consideration. R.C.M.

N63-10102 Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio

ELECTRON-BEAM WELDING OF TUNGSTEN

R. E. Monroe and R. M. Evans May 21, 1962 19 p 3 refs

(Contract AF 33(616)-7747)

(DMIC-MEMO-152)

Reported progress on the electron-beam welding of commercially pure tungsten indicates that sound crack-free welds can be made if the weld is not restrained during welding. Although the data are not all consistent, welds which are smooth and have minimum fusion and heat-affected zone width should be the strongest and most ductile. Tensile strengths are equivalent to the base metal near the recrystallization temperature but are appreciably lower at room temperature. The ductile-to-brittle transition temperatures for electron-beam-welded tungsten are above that of the base metal. The impact resistance of electron-beam-welded tungsten is very low. Electron-beam welding of tungsten parts should be thoroughly evaluated on production prototypes before specifying its use. B.J.C.

N63-10125 Mechanical Technology, Inc., Latham, N.Y.

ANALYSIS OF PLAIN CYLINDRICAL JOURNAL BEARINGS IN TURBULENT REGIME Technical Report

E. B. Arwas, B. Sternlicht, and R. J. Wernick Sept. 1962 42 p 13 refs

(Contract Nonr-3731(00)(FBM))

(MTI-62TR22)

This paper presents a theoretical analysis of the steady-state load carrying capacity, attitude angle, and fluid film stiffness of plain cylindrical journal bearings operating in the turbulent regime. The calculated data on fluid film stiffnesses are included so that they can be used to calculate system critical speeds. In the analysis presented here, side leakage is neglected; however, existing published data on a 360° plain circular bearing was used to establish a correlation factor between laminar and turbulent leakage factors. Author

N63-10144 Rocketdyne, Canoga Park, Calif.

DEVELOPMENT OF LIGHTWEIGHT, SEGMENTED ROCKET MOTOR CASES EMPLOYING FIBERGLASS Second Quarterly Report [July 1-Sept. 30, 1962]

N. F. Scudder Edwards AFB, Calif., Rocket Res. Labs., Oct. 28, 1962 24 p

(Contract AF 04(611)-8185)

(R-3703-2)

This report transmits the technical information dealing with a program for the development of lightweight, segmented motor cases.

Analysis of strength has been continued to include problems of strain compatibility and transition of strain from the all-metal zone to the all-fiberglass zone. Minor design changes are reported. A simple process for fabricating the metal laminae required in the joint construction is described. Author

N63-10160 International Business Machines Corp. Command Control Center. Federal Systems Div., Kingston, N.Y.

THIN FILM PRODUCTION TECHNIQUE Final Report, June 15, 1961 to Oct. 31, 1962

Oct. 31, 1962 72 p 25 refs
(Contract N163-9142(X))

A thin-film production technique is described with regard to equipment design and development of materials and processes. The equipment consists of four modular vacuum chambers fastened together to form a single vacuum space. The materials chosen were copper for conductors and capacitor plates, chromium-silicon monoxide cermet for resistors, and silicon monoxide for insulation and capacitor dielectric. Design features, operational characteristics, and film processes are given in detail. Author

N63-10162 Rock Island Arsenal Lab., Ill.

ORGANIC COATING USING THE FLUIDIZED BED TECHNIQUE Technical Report

L. O. Gilbert Sept. 20, 1962 47 p 1 ref
(RIA-62-3183) OTS: $1.25

Process details, advantages, and deficiencies of the fluidized bed coating process as compared with conventional coating methods, and tricks of the trade are covered. Masking, cold-fixturing techniques, patching of the coatings, inspection techniques, machining, and special applications of the coatings are discussed. Use of the process in applying both plastic and metallic coatings reveals a future application of fluidized bed techniques. Author

N63-10169 General Electric Co., Cincinnati, Ohio

DEVELOPMENT OF ROLL-FORMED TUNGSTEN NOZZLE COMPONENTS Final Report

J. P. Vanden Noort Aug. 31, 1962 49 p 2 refs
(Contract NOw-61-0161-c(FBM))

The shear forming and spinning of commercially available tungsten sheet into nozzle parts of various configurations was demonstrated. The design configurations included convergent/divergent throat sections, "bent-back" and minimum radius flanges, and uniform wall thickness over the length and contour of the part. A total of ten parts were delivered; three exit cone liners, four throat inserts of one design, and three throat inserts of an improved configuration. The nozzle parts were fitted and bonded to graphite substrates and were designed to be included as components of nozzle assemblies. Two such units have been fired. Author

N63-10172 General Motors Corp. New Departure Div., Bristol, Conn.

RESEARCH AND DEVELOPMENT OF AIRFRAME BEARINGS FOR AEROSPACE VEHICLES Progress Report No. 2 [Aug. 1-Oct. 31, 1962]

R. J. Matt, J. B. Muratore, R. E. Murteza, and C. J. Zupkus Nov. 8, 1962 31 p 16 refs
(Contract AF 33(657)-8431)

Rolling and sliding test rigs for operation at -100° F, 1500° F, 2000° F, and 2500° F have been built, tested, and developed to provide satisfactory operation. Empirically developed limiting load determination criteria have been established to qualify the maximum load carrying ability of the superalloy, cermet, and ceramic materials. Approximately 48 Phase 1 tests have been run, and the results have illustrated significant differences in friction and wear performance. Phase 1 testing is now proceeding at an accelerated rate. Phase 2 lubricants will be selected very shortly. The Phase 3 ultrahigh vacuum test apparatus has been installed and has been demonstrated to provide a vacuum of 6×10^{-10} torr under clean and dry conditions. Author

N63-10194 Southwest Research Inst., San Antonio, Tex.

RESEARCH ON HIGH-TEMPERATURE BEARINGS [Final] Technical Report [Mar. 10, 1960-Mar. 1962]

R. D. Brown, R. A. Burton, and P. M. Ku Wright-Patterson AFB, Ohio, Flight Dynamics Lab., Aug. 1962 80 p 15 refs
(Contract AF 33(616)-7209)
(ASD-TR-61-705)

A description is presented of the evaluation work performed on oscillating bearings of both plain journal and self-aligning types. The bearing substrate materials included cermets LT-1B and LT-2, and alloys F-48 and René 41. Lubricants receiving extensive evaluation were a clad silver-palladium alloy, molybdenum disulfide used in cavities, and bonded molybdenum disulfide. Results include those from friction and wear evaluations, radial load capacity tests on plain journal bearings, and axial and radial load capacity tests on self-aligning bearings. Author

N63-10330 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

A MAGNETIC DRIVE

O. A. Motovilov and S. N. Dekha Oct. 9, 1962 6 p Transl. from Soviet Patent No. 143099 (720432/25), March 6, 1961
(FTD-TT-62-1143/1+2+4)

A magnetic drive, which produces rotational motion in a vacuum apparatus, is constructed so that the dimensions of the magnets are decreased without reducing the value of the torques transmitted by the magnets. This is accomplished by placing the magnets in a hermetically sealed box located outside the boundaries of the vacuum apparatus, with the magnets separated by a thin nonmagnetic vacuum-tight membrane. Thus, the driven magnet is removed from the vacuum chamber proper. This ensures the possibility of establishing the necessary gap between the magnetic elements which, in turn, allows their construction out of small permanent magnets. J.R.C.

N63-10358 Alcoa Research Labs., Aluminum Co. of America, New Kensington, Pa.

DEVELOPMENT OF ALUMINUM-BASE ALLOYS Annual Progress Report for the Period Sept. 29, 1961 to Sept. 30, 1962

R. J. Towner Oct. 16, 1962 52 p 4 refs
(Contract DA-36-034-ORD-3559-RD)
(Rept. 7-62-AP59-8)

An investigation of the feasibility of producing aluminum alloy extrustions with a yield strength at room temperature of 125,000 psi or higher was begun. The powder metallurgy approach was used in an attempt to obtain a combination of age hardening and dispersion hardening in Al-Zn-Mg-Cu alloys to which insoluble alloying elements were added. A method of fabricating atomized alloy powders, which contained the fine dispersion of alloying elements, into relatively large (2 in. dia.) extrusions of high quality was developed. After heat treatment, the highest longitudinal yield strength developed to date was 118,700 psi and the highest tensile strength was 122,400 psi. Three alloys had ratios of yield strength to density of 1.12 million inches. Author

N63-10368 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

CASTED HEAT RESISTANT BILLETS FOR COMBUSTION TURBINE BLADES

Milos Vystyd, Josef Vodsedalek, and Drahomir Suchomel Sept. 19, 1962 14 p 6 refs Transl. from Slevarenstvi (Prague), no. 4, 1960 p 111-114
(FTD-TT-62-789/1+2)

The possibilities of employing casted steel and alloys for turbine blades in the Soviet Union is discussed. Casted blades are shown to be more economic and serviceable than machined blades. It is concluded that casted blades should be considered for long-term usage. R.C.M.

N63-10387 General Electric Co. Defense Systems Dept., King of Prussia, Pa.

FAILURE PREDICTIONS FOR NONMAINTAINABLE ELECTRONIC COMPONENTS

C. W. G. Fulcher *In* Air Force Systems Command. Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif. Transactions of the 7th Symp. on Ballistic Missile and Space Technol., U. S. Air Force Academy, Colo., Aug. 13-16, 1962 Vol. I p 465-492 3 refs (See N63-10370 01-01)

The properties of the absorbing Markov chain were used to predict times to failure for nonmaintainable electronic components, the object being to identify defective components which fail before the end of design life although acceptance test performance is within design tolerances. Predicted failure times for several prototype electronic elements are compared to actual times. Author

N63-10426 Naval Research Lab., Washington, D.C.

ULTRASONIC INSPECTION OF TUNGSTEN ROUND ROBIN BILLETS, PHASE I

Stephen D. Hart and Louis C. Cardinal Oct. 29, 1962 17 p
(NRL Tech. Memo 214)

Ultrasonic inspection of tungsten round robin billets was conducted to determine the following: best transducer frequency; method of waterproof wrapping of uninfiltrated billets for immersed inspection; velocity of sound measurements to detect density variations; and detection of internal defects by both longitudinal and shear waves. J.R.C.

N63-10457 Arde-Portland, Inc., Paramus, N.J.

CRYOGENIC STRETCH FORMING OF SOLID PROPELLANT ROCKET CASES Quarterly Technical Report No. 1, June 1, 1962 to Sept. 1, 1962

George Claffy [1962] 19 p
(Contract DA-30-069-ORD-3501)

The cryogenic stretch forming process is used to produce experimental flight weight solid propellant rocket cases of the Pershing configuration. This report covers the following: program plan; aft head; skirt attachment; elliptical forward head; forming tank; and materials used. J.R.C.

N63-10545 Rohm and Haas Co., Huntsville, Ala.

DEVELOPMENT OF A HOT GAS VALVE

William C. Stone Nov. 30, 1962 18 p
(Contract DA-01-021-ORD-11878)
(S-37)

A unique hot gas valve incorporating a replaceable seat seal for positive and reliable sealing was designed, fabricated, and tested with both aluminized and nonaluminized propellants. Three hot firings were conducted with durations up to 28 seconds. The unique sealing method worked well with nonaluminized propellant, but the experimental valve withstood the hotter exhaust from an aluminized propellant for only 14 seconds. Modifications to the present design could probably produce a significantly improved valve for use with aluminized propellants. Author

18 MATERIALS, METALLIC

Includes: cermets; mechanical and physical properties of alloys and metals; and metallurgy.

***For related information see:* 07 Chemistry; 17 Machine Elements and Processes; 19 Materials, Nonmetallic; 33 Stresses and Loads; and 34 Structural Design.**

N63-10103 General Electric Co. Flight Propulsion Lab. Dept., Cincinnati, Ohio

HIGH-TEMPERATURE MATERIALS PROGRAM Progress Report No. 17, Part A

Nov. 15, 1962 52 p 15 refs
(Contract AT(40-1)-2847)
(GEMP-17A) OTS: $1.25

This report on high-temperature materials covers the following: oxidation resistant fuel element materials; high-temperature reactor materials fabrication; effects of radiation on high-temperature alloys; and long-term irradiation tests of 80Ni-20Cr fuel element specimens. J.R.C.

N63-10110 Naval Ordnance Lab., White Oak, Md.

THE PERFORMANCE OF SELECTED PLASTICS MATERIALS IN A HIGH TEMPERATURE ENVIRONMENT

Aaron Fisher, M. A. Kinna, F. J. Koubek, and F. Robert Barnet Sept. 1962 89 p 7 refs
(NAVWEPS-7390)

A variety of plastics materials were studied to gain data on their performance characteristics under neutral oxy-acetylene flame test conditions. The effectiveness of refractory filler systems for the reduction of erosion rate and thermal conductivity was also investigated. With the exception of zirconia, most refractory fillers added to phenolic resins did not improve erosion and insulation characteristics. Author

N63-10126 Bureau of Mines, Washington, D. C.

CEMENTED TUNGSTEN CARBIDE WITH TITANIUM DIBORIDE ADDITIONS

M[iles] E. Tyrrell and Gilbert M. Farrior 1962 15 p 6 refs
(BM-RI-6095)

Minor additions of titanium diboride to mixtures of 94 percent WC and 6 percent Co decrease mechanical strength but increase oxidation resistance in proportion to the amount of the addition. One percent of titanium diboride increased the hardness by 2 Rockwell A units. Hot-pressing produced compacts with the highest density and the best mechanical strength, but losses of cobalt were high and grain growth was pronounced. Author

N63-10127 Bureau of Mines, Washington, D. C.

COLUMBIUM-HAFNIUM BINARY ALLOYS FOR ELEVATED-TEMPERATURE SERVICE

H[erbert] R. Babitzke, G. Asai, and H. Kato 1962 21 p 9 refs
(BM-RI-6101)

Work was conducted to determine the properties of columbium-hafnium alloys and to select the more promising ones for further improvement. Properties determined were machinability, hardness, workability, tensile strength, and oxidation resistance. Ten ingots, ranging from 100 percent columbium to 70 atomic-percent hafnium, were prepared and subjected to tests. The test results showed that the alloys with 33 and 50 atomic-percent hafnium were superior in workability, strength, and oxidation resistance. For the alloy series tested, the strength and hardness values increased with the increasing

hafnium content. Maximum values were reached with 50 atomic-percent hafnium. The oxidation resistance was poorest at the 1 atomic-percent hafnium level but improved with increasing hafnium content through 70 atomic-percent. Eight of the ten ingots were fabricable at room temperature. The two remaining ingots, those with 5 and 10 atomic-percent hafnium, required hot-working. Author

N63-10154 Frankford Arsenal. Pitman-Dunn Labs., Philadelphia, Pa.

LIQUID METAL EMBRITTLEMENT OF A Cu-2% Be ALLOY [Technical Report]

James V. Rinnovatore Aug. 1962 16 p 3 refs
(Rept. R-1652)

The propensity toward brittle fracture of a Cu-2% Be alloy in the presence of a 2% Na amalgam was investigated. Tensile properties of the alloy in the dry and wetted conditions were determined as a function of the following thermal-mechanical histories: solution treated ("A" condition) and aged at 700° F; solution treated plus maximum cold rolled ("H" condition) and aged at 700° F; solution treated, aged at 700° F for 1 hour, and cold worked; solution treated, aged at 700° F for 9 hours, and cold worked; solution treated and aged at 400° F; solution treated and cold worked. The results obtained from the conditions listed above showed that wetted fracture behavior was more affected by the manner in which the alloy was treated to obtain a particular strength than by the actual magnitude of the strength. Author

N63-10157 General Electric Co. Flight Propulsion Lab. Dept., Cincinnati, Ohio

METALLIC FUEL ELEMENT MATERIALS. Comprehensive Technical Report, General Electric Direct-Air-Cycle, Aircraft Nuclear Propulsion Program

R. C. Lever Washington, AEC Div. of Tech. Inform., June 20, 1962 159 p 86 refs
(Contracts AF 33(600)-38062 and AT(11-1)-171)
(APEX-913) OTS: $2.75

Information on properties, fabrication procedures, test data, and technical developments in high-temperature gas-cooled metallic nuclear-fuel element technology is presented. Nuclear-fuel element materials suitable for gas-cooled reactors with gas exit temperatures of from 1200° F to somewhat higher than 2000° F are discussed and test results summarized. The report includes discussions and data on nuclear-fuel elements containing dispersed uranium dioxide with a matrix and cladding of stainless steel, nickel-chromium alloy, iron-chromium-yttrium alloy, iron-chromium-aluminum alloy, niobium alloy, or chromium alloy. B.J.C.

N63-10282 Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio

IDENTIFICATION OF MICROCONSTITUENTS IN SUPERALLOYS

C. H. Lund and H. J. Wagner Nov. 15, 1962 31 p 41 refs
(Contract AF 33(616)-7747)
(DMIC-MEMO-160)

A discussion is given of the methods used to identify microconstituents in superalloys. These methods include the following: simple optical-microscopic examination; X-ray and electron diffraction techniques; and the extraction replica technique. J.R.C.

N63-10289 Denver Research Inst., Colo.

RESEARCH ON THE EFFECT OF SELECTED RARE-EARTH SCAVENGERS ON THE PROPERTIES OF TUNGSTEN AND MOLYBDENUM Quarterly Progress Report No. 3, 1 Aug. through 31 Oct. 1962

C. Samuel Miller and Donald T. Klodt Nov. 1962 17 p
(NASA Grant NsG 61-60, Suppl. 3-63)
(DRI-2068) OTS: $1.60 ph, $0.80 mf

An investigation is made of a scavenging method designed to remove the interstitial oxygen and nitrogen from arc-melted tungsten and molybdenum, and to convert the grain boundary films to less harmful forms. Addition of 1.0 weight percent, or less, of yttrium or a rare-earth metal are arc melted with tungsten and molybdenum to act as a getter of the oxygen and nitrogen and form stable, inert oxides and nitrides. Small diameter (7/8 inch) ingots are produced by melting compacted powder charges in a continuous casting, nonconsumable electrode furnace. The ingots are machined to remove surface defects and then swaged into rods which are recrystallized prior to machining into test specimens. A nonstandard cylindrical Charpy test specimen is tested by impact loading at various temperatures, and the ductile-to-brittle transition temperature is determined. The lowering of the ductile-to-brittle transition temperature is the criterion for ductility and is a qualitative indication of the effectiveness of the scavenging action of the addition metal. J.R.C.

N63-10294 General Electric Co., Evendale, Ohio

DETERMINATION OF ENGINEERING PROPERTIES OF MAR-STRAINED STEELS [Final] Technical Documentary Report [Nov. 15, 1960-Jan. 12, 1962]

R. E. Yount Wright-Patterson AFB, Ohio, Directorate of Materials and Processes, Aug. 1962 155 p 7 refs
(Contract AF 33(616)-7655)
(ASD-TDR-62-230)

The Mar-Strain response (the addition of strain and aging to quenched and tempered steels) was determined for eight alloys representing four classes of steel: low alloy martensitics, secondary hardening martensitics (hot work die steels), semi-austenitic and martensitic stainless. All four alloy classes responded to the process by demonstrating yield strength increases of 10% to 20%. It was found that the tempered structure and strain hardening characteristics were the most significant factors controlling the Mar-Strain response. Two alloys were selected for determination of their engineering properties including uniaxial tensile, fatigue and center notch properties and biaxial performance in sub-scale cylinder tests. One alloy, Ladish D6AC (.46%C, 1%Cr, 1%Mo), was capable of being Mar-Strained to a 275,000 psi .2% yield strength. A second alloy, Modified S-5 (.48%C, 2%Si, .5%Mo, .25%V), was capable of being Mar-Strained to a 300,000 psi .2% yield strength. Mar-Straining was found to increase the fatigue strength of both alloys. The process was adequately demonstrated in the sub-scale pressure vessel tests. Burst strengths (greater than 350,000 psi hoop) achieved with the Mar-Strained S-5 cylinders were higher than any previously reported for a homogeneous material. Author

N63-10311 Nuclear Metals, Inc., Concord, Mass.

BERYLLIUM RESEARCH AND DEVELOPMENT PROGRAM Quarterly Progress Report for the Period Apr. 1 through June 30, 1962

S. H. Gelles Nov. 5, 1962 82 p 27 refs
(Contract AF 33(616)-7065)
(NMI-9522)

Beryllium research continues in the following areas: brittle behavior by means of transmission electron microscopy; ductile-brittle transition; recrystallization and grain growth; identification of impurities and precipitates; and fabrication of fine-grained beryllium from ultrafine powders. R.C.M.

N63-10340 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

NOBIUM AND ITS ALLOYS

G. B. Zakharova, D. B. Mishina, and E. Ya. Velmozhnyy Sept. 17, 1962 13 p 10 refs Transl. from Tsvetnye Metal (Moscow), no. 4, 1962 p 88-92
(FTD-TT-62-1256/1+2)

Sources, production figures, and uses for niobium are given. Comparisons of the properties of niobium with tungsten, tantalum, and molybdenum are made. Because of the characteristics of niobium, particularly its low melting point, low specific gravity, excellent weldability, and high heat resistance, it is believed that its alloys will find broad application in the role of structural materials in aviation and rocket technology, nuclear power, radio electronics, and instrumentation. P.F.E.

N63-10410 Rolla Metallurgy Research Center, Bureau of Mines, Mo.

VIBRATION DAMPING CAPACITY OF VARIOUS MAGNESIUM ALLOYS

D. F. Walsh, J. W. Jensen, and J. A. Rowland 1962 20 p refs (BM-RI-6116)

A study of damping capacity was made on a number of magnesium-base alloys, commercial types and experimental compositions. Hardness and tensile properties were determined, and the microstructure of each alloy was examined. Alloys of low yield strength, in general, possessed high damping ability. A correlation was established between damping capacity and composition. Author

N63-10450 Illinois Inst. of Tech., Chicago

SINGLE BOUNDARY MIGRATION IN DEFORMED CRYSTALS OF ALUMINUM Technical Report Nos. 5 and 12

B. B. Rath (Ph.D. Thesis) and Paul Gordon Oct. 1962 31 p 15 refs

(Grant DA-ARO-(D)-31-124-G95; Contract Nonr-1406 (03)) (AROD-2205-4)

Single boundary migration has been studied in deformed single crystals of zone-refined aluminum containing .008 and .016 wgt % copper. It was found that the boundaries could be divided into two groups—special and random—on the basis of relative crystal orientation between the recrystallizing grain and the deformed single crystal matrix. The special boundaries exhibited higher migration rates and lower apparent activation energies for migration than did the random boundaries. Within both groups of boundaries those in the samples containing 0.016 wgt % copper in solution showed lower migration rates and higher apparent activation energies than those in the samples containing 0.008 wgt % copper. The effects of both the dissolved copper and of the relative crystal orientations on the migration rates have been rationalized on the basis of the theory first advanced by Lucke and Detert and subsequently modified and extended by Gordon and Vandermeer. Author

N63-10478 Atomic Energy Commission. Div. of Technical Information, Washington, D.C.

BORIDES OF THE RARE EARTH METALS

Grigorii Valentinovich Samsonov and Yurii Borisovich Paderno Oct. 1962 109 p 162 refs Transl. by JPRS of "Boridy Redkozemel'nykh Metallov" Kiev, Publishing House of the Acad. of Sci. Ukranian SSR, 1961

(AEC-TR-5264) OTS: $2.25

This book discusses the physical and chemical properties of compounds of metals of subgroups IIa and IIIa of the periodic system with boron; methods of their preparation and basic regions of use are described. The book is designed for scientific workers and engineers working in the field of cathode electronics, high-power electronic devices, as well as the synthesis of refractory compounds. Author

N63-10520 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

METALLURGY, METALLOGRAPHY, AND PHYSICAL-CHEMICAL INVESTIGATION METHODS (SELECTED ARTICLES)

Bi Tsin-Khua et al Sept. 7, 1962 145 p 186 refs Transl. of seven articles from Akad. Nauk SSSR, Inst. Met., Tr. (Moscow), no. 8, 1961 p 54-106, 120-127, 149-165, 269-277

(FTD-TT-62-134/1)

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2. VANADIUM AND THE AREAS OF ITS APPLICATION N. I. Kornilov and N. M. Matveyeva p 7-47 43 refs
3. THE METALLOCHEMISTRY OF VANADIUM I. I. Kornilov and N. M. Matveyeva p 48-90 71 refs
4. RESEARCH ON VANADIUM-COPPER-CARBON AND VANADIUM-COPPER-ALUMINUM ALLOYS Ye. M. Savitskiy, V. V. Baron, and Yu. V. Yefimov p 91-102 8 refs
5. THE INFLUENCE OF TENSILE STRESSES ON THE CORROSION RATE OF METALS V. V. Romanov p 103-120 35 refs
6. THE INFLUENCE OF POLARIZATION AND PB-5 INHIBITOR ON THE CORROSIVE DECREPITATION OF CARBON STEELS S. B. Fel'gina and V. V. Romanov p 121-130 10 refs
7. THE STRUCTURE AND PROPERTIES OF ALLOYS AT THE NIOBIUM CORNER OF THE NIOBIUM-VANADIUM-ALUMINUM SYSTEM V. V. Baron, M. I. Agafonova, and Ye. M. Savitskiy p 131-141 7 refs

19 MATERIALS, NON-METALLIC

Includes: mechanical and physical properties of non-metals (e.g., plastics).

For related information see: 07 Chemistry; 17 Machine Elements and Processes; 18 Materials, Metallic; 33 Stresses and Loads; and 34 Structural Design.

N63-10073 Army Chemical Research and Development Labs., Army Chemical Center, Md.

ELEVENTH MATERIALS REVIEW

Arthur Lyem Apr. 1962 108 p 360 refs For Tenth Materials Review see N62-10663 03-18

(CRDL-SP-4-34)

The literature survey culminating in this review provides selected information concerning recent worldwide technological advances that are presented under the following five major headings: high polymers, plastic materials, synthetic fibers, miscellaneous organic and inorganic materials, and metals. Over 350 articles have been abstracted from various publications and languages. Materials and technological aspects are discussed briefly, and a complete bibliography is given. Author

N63-10078 Hughes Aircraft Co., Culver City, Calif.

RESEARCH STUDY: SURVEYOR STERILIZATION. PART I: COMPATIBILITY OF MATERIALS AND COMPONENTS WITH HEAT AND ETHYLENE OXIDE-FREON 12

Myra Willard Jan. 1962 25 p 5 refs

(Rept. RS-277)

Materials and components to be used in the Surveyor spacecraft were evaluated for compatibility with 12% ethylene oxide -88% Freon 12 sterilant gas mixture, and for resistance to exposure to 257° F for 48 hours. Neither exposure to the gas nor to a temperature of 257° F was particularly detrimental to the materials and components. Sterilant gas exposure had the greatest effect on RTV 731 and Epoxylite 5302 adhesives, and neoprene and LS-53 elastomers. Author

N63-10099 Avco Corp. Research and Advanced Development Div., Wilmington, Mass.

BEHAVIOR OF PURE AND REINFORCED CHARRING POLYMERS DURING ABLATION UNDER HYPERVELOCITY RE-ENTRY CONDITIONS

L. McAllister, J. Bolger, E. McCaffery, P. Roy, A. C. Walker, Jr., and F. Ward (Texaco Corp., Beacon, N. Y.) [1962] 50 p 17 refs

(Contract AF 04(647)-258)

Arc tests conducted on a series of cured epoxy resins indicated that a novolac structure in the polymer, and a system functionality in excess of 2.14 and possibly as high as 2.6, are necessary for ablative char formation in the systems tested. In addition, certain acids, when added to noncharring epoxies, induced char formation in arc tests. Photomicrographs of char layer cross sections show details of pyrolytic graphite microstructure and graphite-silica interactions. X-ray diffraction patterns show that silicon carbide is the principal crystalline component in the surface zone of the char layer of the silica reinforced materials. Examination of arc specimens indicates that the char layer fluctuates in thickness, but shows an average increase in thickness during the exposure. The fluctuation in thickness appears to be due to a periodic weakening and removal of the char surface zone. Author

N63-10111 Naval Ordnance Lab., White Oak, Md.

THE POLYMERIZATION OF ROOM TEMPERATURE CURING EPOXY RESINS

Doris V. Steele Oct. 1962 39 p 16 refs

(NOLTR-62-1)

The effect of resin mass on the degree of crosslinking during the initial polymerization of three typical inert filled epoxy resin compounds was determined by electrical resistivity techniques. After the initial polymerization, the extent of additional crosslinking during sixteen months' storage was determined to find out if, and when, the polymerization process was completed and stability of the polymer structure was obtained. Test data show that large masses of a resin will exhibit higher crosslinking if accelerated by an exothermic reaction during the initial polymerization period. In systems which do not exhibit an exothermic reaction, the rate of polymerization is slow and is not affected by resin mass. Author

N63-10112 Solar, San Diego, Calif.

EXPLORATION AND EVALUATION OF NEW GLASSES IN FIBER FORM Bi-monthly Progress Report No. 5, 16 July 1962 through 15 Sept. 1962

Gunther K. Schmitz, John A. Bauer, and Robert M. Gardner Oct. 25, 1962 36 p 5 refs

(Contract Nonr-3654(00)(X))

(RDR-1266-6; Tech. Memo 200)

Drawing of E-glass fibers for length effect study has commenced. Fibers from 994 glass composition were drawn tentatively for the same purpose. Short-fiber tensile tests on fibers from S-994 strand showed considerable data scatter in contrast to previous X-994 results. Strength data fell within the strength-length envelope of X-994 fibers. Fiber slippage in gripping wax was studied critically and was found to have negligible effect on gage lengths above 0.1 cm. The increasing effect on shorter fiber lengths depends on the slope of the strength versus length curve. Analysis of failure distribution curves of X-994 fibers in the short-fiber range indicates the presence of two types of defects, surface and possibly structural. The effect on strength of the two types varies proportionally as fiber length decreases. A theoretical treatment of failure distributions resulting from mixed flaw populations supports analysis of test results. Author

N63-10163 Picatinny Arsenal. Plastics Technical Evaluation Center, Dover, N. J.

HEALTH HAZARDS AND TOXICITY OF PLASTICS: A CROSS-INDEXED BIBLIOGRAPHY

Arnold E. Molzon Mar. 1962 25 p 81 refs

(PLASTEC-5) OTS: $0.75

Selected references pertaining to the toxicity and/or health hazards present during the fabrication of plastics and their normal use are listed. References on health hazards of plastics in medical applications are treated in a separate publication. Author

N63-10170 Picatinny Arsenal. Plastics Technical Evaluation Center, Dover, N. J.

EFFECTS OF THE SPACE ENVIRONMENT ON PLASTICS: A SUMMARY WITH ANNOTATED BIBLIOGRAPHY

Arthur H. Landrock July 1962 88 p 202 refs

(PLASTEC Rept. 12) OTS: $2.25

A brief summary outlines the various space environmental factors, natural and induced, and discusses their effects on plastics and related materials. These factors are: ultraviolet radiation, high-vacuum environment, temperature extremes, high-energy radiation and high-energy particles, sputtering, and micrometeorite erosion. Structural plastics, coatings, and elastomeric materials are considered. The bibliography lists 202 selected references. In the annotations, plastic materials covered in the references are listed, and results and conclusions are outlined when feasible. The arrangement is alphabetical by author. An index in depth is provided, covering both materials and subjects. This index is supplemented with additional indexes listing personal and corporate authors, military contract numbers, ASTIA AD numbers, report numbers, and technical conferences. Author

N63-10353 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

RELATION BETWEEN STRUCTURE AND PROPERTIES OF GLASS

K. S. Yevstropyev Oct. 9, 1962 17 p 15 refs Transl. from Trudy Tret'ego Vsesoyunogo Soveshohaniya, Leningrad, Third All-Union Congress, 1959 p 39-48

(FTD-TT-62-1213/1+2)

The physical and chemical properties of glasses are discussed and related to their structural transformations and thermal history. The vitreous systems discussed include sodium borate, lead borate, alkalisilicate, dialkali borate, and phosphate. The need for more data on the oxygenous glass systems is discussed. R.C.M.

N63-10359 Telecomputing Corp. Marmco Research and Development Div., San Diego, Calif.

POTENTIAL OF FILAMENT WOUND COMPOSITES Monthly Progress Report No. 18, Covering Period 1 Oct. to 31 Oct. 1962

D. Stevens and W. Otto Oct. 1962 23 p refs

(Contract NOw 61-0623-c (FBM))

A number of collimation tests were made on various production strands and roving, and the test data is tabulated. Continued work on single-filament pull-out tests is reported and the developed test procedures are described. Biaxial tests on "Scotchply" fiber glass composites are described. The test specimens in the maltese cross configuration are described along with the test procedure. Some surprising strength and stress-strain data are reported, and future tests to explain the data are outlined. Author

N63-10436 Army Chemical Center. Army Chemical Research and Development Labs., Md.

TWELFTH MATERIALS REVIEW

Arthur Lyem Nov. 1962 121 p 387 refs For Eleventh Materials Review see N63-10073 01-19

(CRDL-SP-5-1)

The purpose of this periodic review is to present important technical and scientific highlights regarding materials research here and

abroad, principally in the polymer and plastics fields. The information is intended to serve as a timely and convenient reference for CBR (Chemical-Bilogical-Radiological) Laboratories and activities and, particularly, for development personnel seeking information about engineering materials of actual or potential interest in creating more efficient or economical end items. Thus, technical literature surveys culminating in "Materials Reviews" will promote dissemination of selected information concerning recent worldwide technological advances that may help to guide future CBR and other Department of Defense exploitation of synthetics and other new materials and techniques. Author

N63-10474 Snell (Foster D.), Inc., New York, N. Y.

DEVELOPMENT OF A SPRAYABLE, STRIPPABLE, PROTECTIVE COATING FOR AIRCRAFT, ROCKETS AND MISSILES Final Report

N. Sergienko, R. W. Allan, and G. R. Weissman Jan. 10, 1962 55 p

(Contract NOw-61-0469)

Test results are given on the evaluation of plasticizers, surfactants and thickeners as modifiers in Geon Latex 652 vehicles. An improved formulation, No. 2911-1-380-3, for a white, sprayable, strippable, protective coating is given. Author

N63-10503 Illinois U., Urbana

MICROSCOPIC STUDY OF MODE OF FRACTURE IN FILAMENT WOUND GLASS-RESIN COMPOSITES

Charles Anton Bouc Nov. 1962 61 p 10 refs

(Contract Nonr-2947(02)(x))

(T&AM Rept. 234; Tech. Memo. 189)

Filament wound glass-resin specimens were sucessfully developed to approximately simulate a typical filament-wound composite, such as found in pressure vessels and fuel tanks. During tensile loading, each specimen was carefully scanned thru a microscope at a magnification of x200, and a written and photographic record was made of the progress of the fracture phenomena. The information thus obtained was synthesized into identification of five different microscopic modes of fracture. The original and nature of these different fracture modes was investigated with the aid of microphotographs, and their contribution to the progressive and ultimate fracture of the specimens determined. Author

N63-10516 Telecomputing Corp. Narmco Research and Development Div., San Diego, Calif.

DETERMINATION OF THE PERFORMANCE OF PLASTIC LAMINATES UNDER CRYOGENIC TEMPERATURES [Final Report, May 1, 1961-July 31, 1962]

Norman O. Brink Wright-Patterson AFB, Ohio, Directorate of Materials and Processes, Aug. 1962 72 p 1 ref

(Contract AF 33(616)-8289)

(ASD-TDR-62-794)

The main objective of this program was to determine the performance of various reinforced plastic laminates at different cryogenic temperatures. Ten materials were evaluated, and represented the epoxy, phenolic, polyester, high temperature polyester, and silicone resin systems. The materials were tested in tension, compression, flexure, and tensile fatigue. Test temperatures included room, -110° F (dry ice and alcohol), -320° F (liquid nitrogen), and -424° F (liquid hydrogen). Results of this program have shown that the reinforced plastic materials generally increase in strength as the temperature decreases. The laminates maintained the same relative tensile fatigue resistance at the cryogenic temperatures tested when compared to the room temperature results. Author

N63-10557 Union Carbide Corp. Parma Research Lab., Ohio

RESEARCH AND DEVELOPMENT ON ADVANCED GRAPHITE MATERIALS. VOLUME X. THERMAL REACTIVITY OF AROMATIC HYDROCARBONS [Final Report, May 1, 1960-Aug. 1962]

I. C. Lewis and T. Edstrom Wright-Patterson AFB, Ohio, Directorate of Materials and Processes, Aug. 1962 48 p 221 refs

(Contract AF 33(616)-6915)

(WADD-TR-61-72, Vol. X)

A general survey is given of the thermal reactivity of aromatic hydrocarbons to provide information basic to the understanding of the conversion of organic materials to carbon. Differential thermal analysis was employed on 84 aromatic hydrocarbons to delineate the thermal sequences during pyrolysis to 750° C. Absorption spectra, electron spin resonance, chromatography, and molecular weight determinations have been used to determine the mechanisms and structural changes which occur. Author

20 MATHEMATICS

Includes: calculation methods and theory; computers; data processing; and numerical analysis.

For related information see: 08 Communications; 09 Electronics; 10 Facilities; and 22 Navigation and Guidance.

N63-10039 Deutsche Versuchsanstalt für Luft- und Raumfahrt. Inst. für Flugfunk und Mikrowellen, Oberpfaffenhofen (W. Germany)

CODIERUNGSVERFAHREN FÜR NACHRICHTENSYSTEME DER RAUMFAHRT [CODING METHOD FOR A REPORTING SYSTEM IN SPACE TRAVEL]

Philipp Hartl Sept. 10, 1962 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-11, 1962

(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 43) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

The coding of information to be transmitted from the space vehicle to the ground station is discussed. The number of information sources is unusually large and the structure of their information signals is heterogeneous. With the great number of signals to be transmitted, the necessity for a uniform and homogeneous form of representation has grown. This need is due to the necessity for optimal design in information systems. Coding problems are dealt with, which are related to the white gaussian noise, that has so much influence on information systems in space travel. The characteristics of the optimal receiver types are discussed. As examples of coding methods, orthogonal, biorthogonal, and transorthogonal codes are discussed. A.S.

N63-10042 Deutsche Versuchsanstalt für Luft- und Raumfahrt. Inst. für Flugfunk und Mikrowellen, Oberpfaffenhofen (W. Germany)

ANALOGE RECHENMETHODEN ZUR SCHNELLEN PRODUKT- UND QUOTIENTENBILDUNG [ANALOG COMPUTATION METHODS FOR RAPID PRODUCT AND QUOTIENT PRODUCTION]

S. Starker Sept. 10, 1962 16 p In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-11, 1962

(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 46) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

In analog computation processes the purpose is to solve a computational problem with the aid of a physical model. In this process, mathematical quantities are coordinated with corresponding physical quantities by laws to which they both conform, as demanded by the problem. The methods developed for these purposes are still designated as analog computation methods even when they do not use physical models, but when they are utilized to transform physical quantities directly. This type of application is frequently used in analog computation of measurement data where great accuracy of

the process is often unimportant but in which simplicity and high speed of computation are of the utmost importance. Various circuits are described which accomplish multiplication and division by formula, in accordance with the requirements mentioned previously. Wave forms, circuit diagrams, and block diagrams of the various circuits employed are also included in this paper. A.S.

N63-10043 Deutsche Forschungsanstalt für Luft- und Raumfahrt. Inst. für Flugmechanik, Brunswick (W. Germany)

ZUR MESSUNG VON FREQUENZGÄNGEN MITTELS DER SYSTEMTHEORIE FÜR REGELLOSE VORGANGE [EVALUATION OF FREQUENCY MOTION METHODS IN THE SYSTEM THEORY FOR RANDOM MOTION]

L. Koch 1962 26 p 12 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-11, 1962

(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 48) Available from WGL, Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

The frequency characteristics of helicopter rotors is being studied by the System Theory for Random Motion with the aid of the light ray oscillograph and magnetic data storage and automatic scanning. Furthermore, it has been demonstrated that with regard to the measurement and computation techniques for stochastic processes, an entire series of problems still exists that cannot be solved by processes known at the present time. Further applications of the System Theory for Random Motion are in preparation. The aim of this research, which is to be carried out on fast airplanes, is the determination of the coefficient for the frequency characteristics that the aircraft motion describes. A.S.

N63-10054 Deutsche, Versuchsanstalt für Luft- und Raumfahrt. Inst. für Luftstrahlantriebe, Porz-Wahn (W. Germany)

VERSUCHE ÜBER DAS CHEMISCHE UND PHYSIKALISCHE VERHALTEN VON LOSCHMITTELN, INSBESONDERE VON HALONEN (VORLÄUFIGE FASSUNG) [EXPERIMENTS ON THE CHEMICAL AND PHYSICAL BEHAVIOR OF EXTINGUISHING AGENTS, IN PARTICULAR OF HALONES] (PRELIMINARY VERSION)

K. Dehn and R. Fiala Sept. 1962 18 p 7 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-12, 1962

(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 20) Available from Friedrich Vieweg & Son, Burgplatz, Brunswick, W. Germany

In the combustion chamber of an air-jet engine, the maintaining of the flame and prevention of its extinction with certainty is the primary concern. This document describes the influence of a number of specific chemical compounds on combustion. The compounds are "Halones" (halogen substitution products of paraffin). A.S.

N63-10076 Daniel, Mann, Johnson and Meddenhall and Associates, Los Angeles, Calif.

WHITE SANDS MISSILE RANGE DATA SYSTEM. VOLUME 1: DESIGN [Final Report]

Jan 2, 1962 125 p

(Contract DA-29-040-ORD-2517)

(SDR-62-1)

A data system is presented which considers all range operations performed at the White Sands Missile Range. The principal functions and responsibilities of the data system within the overall range operations are as follows: to develop measurement plans including optimum selection of instruments and instrument sites for a given mission; to produce in real time internal and external measurement parameters of a test vehicle; to provide quick look data for a given mission within four hours after a mission has been completed; and to produce post-test reports within 24 hours after a mission has been completed. The data system design is based upon two basic measurement techniques—external measurements (trajectory) and internal measurements (telemetry). J.R.C.

N63-10097 Northwestern U., Evanston, Ill.

GENERALIZED BAYES SOLUTIONS IN ESTIMATION PROBLEMS

Jerome Sacks [1961] 33 p 3 refs

(Contract AF 49(638)-877)

The general estimation problem is considered with the space of states of nature $\Omega = \{\omega\}$ a subset of the reals, decision space $T = \{t\} = \Omega$, loss function W, a fixed number of observations n, and $x = (x_1, \ldots, x_n)$ the observation vector having density $p(x,\omega)$ with respect to some σ-finite measure μ when ω is true. For such a problem a decision function δ is called a Generalized Bayes Solution with respect to a measure F on Ω which gives finite measure to bounded subsets of Ω if, for almost all $x(\mu)$, δ selects (perhaps in a randomized way) a decision among those t's which minimize the a posteriori loss. When F is a probability measure or a finite measure (as would be the case if Ω were bounded) δ is a Bayes solution so that the generalization is reached only when Ω is unbounded and $F(\Omega) = +\infty$. J.R.C.

N63-10116 International Business Machines Corp. Thomas J. Watson Research Center, Yorktown Heights, N. Y.

ADAPTIVE MAN-MACHINE CONCEPT-PROCESSING

Manfred Kochen, C. T. Abraham, and E. Wong June 14, 1962 161 p 40 refs

(Contract AF 19(604)-8446)

(AFCRL-62-397)

An adaptive man-machine nonarithmetical information processing system is proposed. A model for its analysis has been formulated and enough of its functions specified to affirm feasibility. The system centers around a novel type of memory organization and a formal language for representing and recording information. The memory is regarded as a large network of names interlinked through various predicates. Each name is characterized by how it is embedded in this net. Local concentrations of densely inter-connected names form the basis of memory organization. This organization adapts to the incoming stream of information and queries. Queries are posed and answered, both by user and machine, in a conversational process during which the user's and machine's level of informedness about the topic are matched. The key theoretical problem is to estimate the length of the "training" period before queries can be adequately serviced. Critical information content and minimal processing capabilities to produce useful machine responses are mathematically analyzed. Author

N63-10156 Virginia Agricultural Experiment Station, Blacksburg

RESEARCH ON ORDER STATISTICS AND THE DESIGN OF EXPERIMENTS. PAIR, TRIANGLE, AND DUO-TRIO TESTS

H. A. David and M. C. Trivedi July 1962 31 p 1 ref

(Grant DA-ORD-29)

(Tech. Rept. 55; AROD-2763-12)

Some methods are reported on for the selection of good judges. These are based on three elementary arrangements, the pair, triangle, and duo-trio tests. A detailed study is made of the effectiveness of these three very simple arrangements on the assumption that the distribution of the underlying response variable is normal or rectangular. One finding is that the results are not much affected by which of these two very different distributions applies. In all three arrangements only two different objects are involved. For maximum effectiveness in the selection of judges there is, for each test and sample size (number of judges), an optimal difference between these objects. It is shown how the difference may be determined. The triangle test appears to perform best from the point of view of selecting judges. While this is the main purpose of the three tests, they may also be used to detect small differences between two objects under comparison. In this situation the pair test is clearly superior to the others. Author

N63-10166 RIAS, Baltimore, Md.

AXIOMATIC THEORY OF CONTROL SYSTEMS

Emilio O. Roxin (Buenos Aires U.) Aug. 1962 66 p 13 refs
(NASA Contract NASr-103; Contract AF 49(638)-382)
(Tech. Rept. 62-16) OTS: $6.60 ph, $2.18 mf

An axiomatic theory is derived to describe the properties of a control system. The attainability function of the system is given as the evolution of its initial state x, the time t, and some control action. Therefore, a given starting point x_0, t_0 and a time $t_1 > t_0$ determine a whole set of possible end states $x(t_1)$, corresponding to all possible choices of the control action. The trajectory of the control action is described and proved to have uniform quasi-asymptotic stability. R.C.M.

N63-10190 New York U. Coll. of Engineering, N. Y.

REPRESENTATIONS FOR CLASS k FUNCTIONS First Scientific Report

A. H. Zemanian Aug. 31, 1962 22 p 11 refs
(Contract AF 19(628)-379)
(AFCRL-62-770)

A general definition of class k transfer functions is constructed as a basis for developing a representation for this class, which is analogous to Cauer's representation for positive-real functions. The definition is in terms of the behavior of the class k functions in the open right-half s-plane and for positive-real functions. This overcomes the requirement for purely imaginary values of s when W(s) is a class k function and permits such functions to have certain types of singularities on the $s = j\omega$ axis. The s-domain is shown to have a unique time-domain representation for the inverse Laplace transform w(t) of W(s) when the region of convergence for w(t) is the open right-half s-plane. It is then shown that the restrictions on w(t), which existed under the restrictive definition of class k functions, still hold under the general definition. R.C.M.

N63-10202 National Aeronautics and Space Administration, Washington, D. C.

MEASUREMENT OF THE STATE VECTOR

C. A. Harvey (Minneapolis-Honeywell Regulator Co.) Nov. 1962 23 p 3 refs Investigation conducted at Minneapolis-Honeywell Regulator Co. under sponsorship of NASA
(NASA Contract NASr-27)
(NASA TN D-1590) OTS: $0.75

Methods are described which may be used to transform the equations of motion of a vehicle to a standard form, measure the state of the system when described in this standard form, and remove first flexure mode effects from pitch-rate signals. Author

N63-10246 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

A METHOD FOR DETERMINING MODAL CHARACTERISTICS OF NONUNIFORM THIN CIRCULAR RINGS

T. E. Lang and R. E. Reed Oct. 1, 1962 3 p For JPL-TR-32-252 see N62-15116 14-32
(NASA Contract NAS7-100)
(JPL-TR-32-252, Addendum No. 1) OTS: $1.10 ph, $0.80 mf

This addendum contains boundary conditions omitted from the original report. These boundary conditions are for the in-plane and out-of-plane cases. R.C.M.

N63-10286 Air Force Cambridge Research Labs. Geophysics Research Directorate, Bedford, Mass.

A COMPUTER PROGRAM FOR SOLVING THE REACTION RATE EQUATIONS IN THE E IONOSPHERIC REGION

Thomas J. Keneshea Aug. 1962 78 p 8 refs
(AFCRL-62-828)

In studies of the mechanisms responsible for the formation of the ionized regions of the atmosphere, one of the problems encountered is the solution of the set of differential equations describing the time dependence of the number density of the chemical species present. For simple cases where only one or two species are involved, there is no particular problem. When all the important constituents are included, however, the solution of these equations becomes very complex. A computer technique is presented that will solve any size set of these differential equations involving any number of chemical reactions. The simultaneous differential equations are solved using the Runge Kutta fourth order process with variable mesh. As soon as a species enters its quasi-equilibrium state, its differential equation is removed from the set and its algebraic equivalent is inserted into the equilibrium set. The solution of the quasi-equilibrium equations is arrived at by the method of successive substitutions. After the first differential equation is removed, the solution from then on is obtained by iteration between the differential and the algebraic sets. To demonstrate its usage, a program package is described which specifically includes seven constituents: O^-, O_2^-, O^+, O_2^+, N_2^+ and NO^+. Author

N63-10287 Rocketdyne, Canoga Park, Calif.

STATISTICAL DESIGN OF COMPLEX EXPERIMENTAL PROGRAMS I. OPTIMUM EXPERIMENTAL DESIGNS OBTAINED BY MINIMIZING A LOSS FUNCTION

Kenneth W. Last Wright-Patterson AFB, Ohio, Aeronautical Research Labs., July 1962 44 p 6 refs For Part II see N63-10288 01-20
(Contract AF 33(616)-7372)
(ARL-62-373, Part I)

A loss function, balancing the value of information against the cost of experimentation, is presented for the case of the m variable linear regression model when experimental costs are a function of the point at which the experiment is performed. Solutions in certain special cases are presented. Author

N63-10288 Rocketdyne, Canoga Park, Calif.

STATISTICAL DESIGN OF COMPLEX EXPERIMENTAL PROGRAMS. II. THE DECISION THEORY OF APPROACH TO COMPLEX EXPERIMENTATION

Mitchell O. Locks Wright-Patterson AFB, Ohio, Aeronautical Research Labs., July 1962 63 p 20 refs For Part I see N63-10287 01-20
(Contract AF 33(616)-7372)
(ARL-62-373, Part II)

A discussion is presented of an application of decision theory to the analysis of the results of multifactorial experiments, and the making of optimum redesign decisions on complex equipment during the period of development. Both the problem of acceptance testing for fixed configurations and that of testing and redesigning variable configurations are treated. A model has been developed and simulated on the IBM 7090 computer. A tentative utility function is presented which incorporates the gain of information from testing and losses due to fluctuations from a planned reliability schedule. Author

N63-10318 RAND Corp., Santa Monica, Calif.

DIFFERENTIAL EQUATIONS FOR GEOMAGNETIC FIELD LINES IN SPACE

W. L. Sibley Oct. 1962 20 p 6 refs
(NASA Contract NASr-21(05))
(RM-3353-NASA) OTS: $1.60 ph, $0.80 mf

The numerical solution of the differential equations describing a field line requires an efficient method for evaluating the expressions for the components of the gradient of the earth's magnetic field. This paper records the necessary transformation from spherical to rectangular form and presents its uses, and details a procedure which provides an efficient method for generating a magnetic field line in rectangular coordinates. It should be noted that the procedure does

not require the evaluation of time-consuming sine and cosine functions. The transformation and its Jacobian provide an easy transition to spherical coordinates. Author

N63-10324 California U., Los Angeles
ON SUCCESSIVE APPROXIMATIONS TO LYAPUNOV FUNCTIONS IN CONTROL OPTIMIZATION PROBLEMS
Masanao Aoki Oct. 1962 23 p 10 refs
(Contract Nonr-233(52))
(Rept. 62-50)

An optimization problem is considered where it is desired to minimize a time integral of a function of state and control variables over a finite control period T, while bringing the system to the origin in time T. An algorithm to successively optimize the control system by constructing a sequence of approximations to a Lyapunov function is proposed under certain analyticity conditions on the control dynamic equation and the criterion function. By this algorithm, nonlinear control optimization problems are reformulated as a sequence of control optimization problems with linear differential equations. The convergence of the algorithm is proved. By assigning specific form to the criterion function, many optimization problems can be treated and approximate solutions can be obtained. Author

N63-10333 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
MOD II RANGING EQUIPMENT
Harold W. Baugh Sept. 15, 1962 45 p
(NASA Contract NAS7-100)
(JPL-TR-32-337) OTS: $4.60 ph, $1.55 mf

An interplanetary ranging system has been built to demonstrate the feasibility of making real-time precision-range measurements at planetary distances. This report describes the Earth-based digital control equipment which performs all of the control and computational functions required for both the flight and ground portions of the system. The central feature of this equipment is the Stored Program Controller (SPC). This device directs the operations of the system and performs necessary calculations according to a program of instructions stored in the machine's memory unit. The SPC may be adapted to new conditions or requirements by means of program changes instead of the hardware changes required in a wired-program device. The report describes the operations of the various sections of the machine in detail, and gives examples of programs which have been used in L-band transponder ranging and acquisition experiments performed both in the laboratory and in helicopter tests. Illustrations are given to show that the equipment is planned and constructed so as to provide for easy expansion of its capabilities. The present capacity, and plans for future construction are described. Author

N63-10350 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio
THE DISSIPATIVITY OF A CERTAIN NONLINEAR SYSTEM OF DIFFERENTIAL EQUATIONS. I
B. P. Demidovich Aug. 29, 1962 13 p 5 refs Transl. from Vestn. Mosk. Univ., Ser. I: Mat. i Mekhan (Moscow), 6, 1961 p 19-27
(FTD-TT-62-1149/1+2+4)

The dissipativity of a nonlinear system of differential equations is given. The sufficient conditions are given such that each solution $\vec{x} = \vec{x}(t)$ of a nonlinear system of ordinary differential equations when $t = T(\vec{x})$ belongs to a certain fixed bounded domain D, i.e., Levinsons' D-property holds. Also, some earlier results are generalized. J.R.C.

N63-10365 Joint Publications Research Service, Washington, D. C.
CYBERNETICS AND THE THEORY OF CONTROL SYSTEMS
O. B. Lupanov and G. M. Ulanov Nov. 19, 1962 19 p 16 refs Transl. of 2 articles from Doklady Akad. Nauk SSSR (Moscow), v 144, no. 6, 1962
(JPRS-16239) OTS: $1.60

CONTENTS:
1. COMPARISON OF THE COMPLEXITY OF REALIZATION OF MONOTIC FUNCTIONS WITH CONTACT CIRCUITS CONTAINING ONLY CLOSING CONTACTS AND WITH ARBITRARY CONTACT CIRCUITS O. B. Lupanov p 1-10 8 refs
2. OPTIMIZATION OF AUTOMATIC CONTROL SYSTEMS AND THE K(D)-IMAGES G. M. Ulanov p 11-16 8 refs

N63-10386 Sylvania Electric Products, Inc. Reconnaissance Systems Labs., Mountain View, Calif.
AN APPLICATION OF A NON-PARAMETRIC TECHNIQUE FOR RELIABILITY COMPARISONS
Kenneth M. Zenkere and Kenneth M. Hall *In* Air Force Systems Command. Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif. Transactions of the 7th Symp. on Ballistic Missile and Space Technol., U.S. Air Force Academy, Colo., Aug. 13-16, 1962 Vol. I p 453-463 3 refs (See N63-10370 01-01)

A frequent problem in the optimization of system effectiveness is to make objective decisions on operational procedures on the basis of limited a priori information. An analysis used to decide an effective maintenance policy for a complex subsystem is discussed. Author

N63-10393 Minneapolis-Honeywell Regulator Co. Aeronautical Div., Minn.
A DIGITAL ADAPTIVE FLIGHT CONTROL SYSTEM FOR FLEXIBLE MISSILES
John F. L. Lee *In* Air Force Systems Command. Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif. Transactions of the 7th Symp. on Ballistic Missile and Space Technol., U.S. Air Force Academy, Colo., Aug. 13-16, 1962 Vol. II p 115-147 5 refs (See N63-10389 01-01)

This paper presents an analysis of a digital adaptive system which is based on the automatic gain-changing principle. The system was applied to stabilize a typical flexible missile having serious body bending effects. The system was designed by analytical methods and simulated on a computer. Performance was in good agreement with analytic predictions. Author

N63-10397 Avco Corp. Research and Advanced Development Div., Wilmington, Mass.
BIOLUMINESCENCE AS A PHYSIOLOGICAL INDEX
Martha D. Berliner and L. L. Laughlin, Jr. *In* Air Force Systems Command. Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif. Transactions of the 7th Symp. on Ballistic Missile and Space Technol., U.S. Air Force Academy, Colo., Aug. 13-16, 1962 Vol. II p 271-281 3 refs (See N63-10389 01-01)
(NASA Contract NASw-389)
OTS: $1.60 ph, $0.80 mf

Certain organisms, particularly wood-decaying fungi, emit a portion of the waste energy of oxidation as light rather than heat. Thus, the cell respiration is intimately connected to the production of light. Changes in the intensity of luminescence serve as an indicator of physiological changes both within the organism and the environment. Several species have proven themselves ideal test organisms and are being intensively studied from all aspects of normal and variable environments. Luminescence is continuous for 30 days or longer, and accurate photometric techniques make monitoring routine. Preliminary work on the effects of temperature, light, X-ray, and ultraviolet irradiation is reported. Effects of other physiological parameters are under continuing study. Author

N63-10398 Northrop Space Labs., Hawthorne, Calif.
LUNAR TRACKER MATHEMATICAL TECHNIQUES AND DIGITAL SIMULATION

G. J. Goodman, R. B. Freund, and H. B. Kennedy *In* Air Force Systems Command. Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif. Transactions of the 7th Symp. on Ballistic Missile and Space Technol., U.S. Air Force Academy, Colo., Aug. 13-16, 1962 Vol. II p 285-320 1 ref (See N63-10389 01-01)
(Contract AF 33(616)-8242)

Optical techniques for lunar flight midcourse tracking of the center of the partially illuminated moon were studied, and an experimental model of a complete tracking system based on one of the techniques was designed, fabricated and tested. This paper discusses the mathematical techniques and the digital simulation of the experimental tracker whose axis is directed toward the center of the moon by means of three measurements of the distance from the axis to the image of the bright limb. The scanning system analytical model, control computer equations, closed-loop servo equations, random errors, and certain hardware nonlinearities included in the simulation are discussed, and simulation results are presented in graphical form. Also presented are two promising methods for extension of the mathematical techniques of the experimental model to close range planet tracking. Author

N63-10400 Lockheed Missiles and Space Co. Research and Engineering Div., Palo Alto, Calif.

A SIMULATION OF MAP CORRELATION FOR BALLISTIC OR ORBITAL WEAPON TERMINAL CORRECTION

Walter Eppler and Robert Willstadter *In* Air Force Systems Command Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif. Transactions of the 7th Symp. on Ballistic Missile and Space Technol., U.S. Air Force Academy, Colo., Aug. 13-16, 1962 Vol. II p 359-387 (See N63-10389 01-01)

This paper describes a laboratory simulation study of a digital map correlation process which can provide a terminal-position vector fix for high accuracy ballistic missile and orbital bomber systems. In this study, the radar signal was simulated by the output of a flying spot scanner operating on high-altitude photographs, sampling and quantization performed using special purpose laboratory equipment and correlation computations made on an IBM 7090. Effects of radar resolution, additive noise, threshold errors, and scale factor errors are treated and both binary and multilevel quantization considered. Results to date are promising for each quantization approach. Author

N63-10401 Northrop Space Labs., Hawthorne, Calif.

CELESTIAL BACKGROUND SIMULATION TECHNIQUES

L. L. Collins and R. B. Freund *In* Air Force Systems Command. Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif. Transactions of the 7th Symp. on Ballistic Missile and Space Technol., U.S. Air Force Academy, Colo., Aug. 13-16, 1962 Vol. II p 389-412 3 refs (See N63-10389 01-01)

Properties of the celestial background pertinent to the problems of space observation systems are discussed. Techniques for digital simulation of these properties are presented including the use of the Boss catalog of stars on IBM punched cards in computations of total luminosity, equivalent magnitude, spectral irradiance, and relative sensor response for the stellar background in any field of view. Equations and numerical results are given for determination of the time varying background type which occurs in the field of view of a satellite observer in a circular orbit viewing a missile on a coplanar elliptical path or another coplanar satellite in a circular orbit. Potential applications of the simulation techniques are discussed. Author

N63-10411 Maryland U. Inst. for Fluid Dynamics and Applied Mathematics, College Park

A PRIORI BOUNDS ON THE DISCRETIZATION ERROR IN THE NUMERICAL SOLUTION OF THE DIRICHLET PROBLEM

J. H. Bramble and B. E. Hubbard Aug. 1962 40 p 19 refs (Contract AF 49(638)-228)
(BN-296)

Explicit a priori bounds are obtained on the discretization error for a certain finite difference analog of the Dirichlet problem for Poisson's equation. The bounds involve square integrals of various derivatives of the data (including the curvature of the boundary which is considered as data). They exhibit $0(h^2)$ asymptotic behavior where h is the mesh constant associated with a square grid. A major purpose of the investigation was to find out how much smoothness should be required of the data to assure convergence of the solution of the analogous linear system to the solution of the Dirichlet problem. For this work it is assumed that the data possesses continuous derivatives of all orders required for the bound. Green's function is defined, and techniques are developed to provide bounds for integrals of the higher order differential invariants by functions which depend on a certain higher order integral identity, given by J. H. Bramble and B. E. Hubbard. Finally, the bound on the discretization error is computed in the case of the torsion function for a class of convex regions. It is observed that the correct result, zero, can be obtained for the circle. P.F.E.

N63-10413 Minneapolis-Honeywell Regulator Co., Minn.

ON THE UNIQUENESS OF TIME-OPTIMAL CONTROL FOR LINEAR PROCESSES

C. A. Harvey and E. B. Lee Repr. from J. Math. Anal. and Appl. v. 5, no. 2, Oct. 1962 p 258-268 11 refs
(NASA Contract NASr-27)

The autonomous linear control problem has been defined as follows:

$$(a)\ \dot{x}_i = \sum_{j=1}^{n} a_{ij}x_j + \sum_{k=1}^{m} b_{ik}u_k; \quad i = 1, 2, \cdots n,$$

(b) the nonempty restraint set $\Omega_1 \mid u_k \mid \leq 1; k = 1, 2 \cdots m.$,
(c) the initial point $x_0 = (x_{10}, x_{20}, \cdots x_{n0}) \in R^n$,
(d) the constant, compact, convex, target set $G \subset R^n$,
(e) the cost functional of control, $C(u) = t_1$.

The problem of optimum control is to select $u(t) = (u_1(t), u_2(t), \cdots u_m(t))$ from Ω for each t, $0 \leq t \leq t_1$, such that $x(t) = (x_1(t), x_2(t), \cdots x_n(t))$ moves from $x(0) = x_0$ to an intersection with the target G in minimum time $t_1 = C(u)$. A control u is called optimal in case $C(u) \leq C(\hat{u})$ for any admissible control $\hat{u} \in \Delta$, where Δ is the class of all measurable controls $u(t) \in \Omega$ on various time intervals $0 \leq t \leq t'$ which "steer" x(t) from x_0 to G. Theorems, definitions, and lemmas which support the solution are discussed. P.F.E.

N63-10414 Minneapolis-Honeywell Regulator Co., Minn.

DETERMINING THE SWITCHING CRITERION FOR TIME-OPTIMAL CONTROL

C. A. Harvey Repr. from J. Math. Anal. and Appl., v. 5, no. 2, Oct. 1962 p 245-257 2 refs
(NASA Contract NASr-27)

A method is presented for determining the switching criterion for time-optimal control. The method is applicable to a class of multivariable control problems, and it is shown how a single-variable control problem may be transformed into a multivariable control problem in this class. Several examples are discussed where the switching curve may be determined explicitly by analytic techniques. In the examples considered here, it is not too difficult to show the surface obtained is the switching surface, but for more general systems this may not be true or at least difficult to verify. Author

N63-10423 Naval Weapons Lab., Dahlgren, Va.

COMPUTING PROGRAMS FOR THE COMPLEX FRESNEL INTEGRAL

A. V. Hershey Nov. 19, 1962 47 p 7 refs
(NWL-1796; NAVWEP-7670)

A rational polynomial approximation is developed for the complex Fresnel integral. The range of validity of the rational approximation is that part of the complex plane on the negative side which is bounded by the imaginary axis and is outside a circle of unit radius. The complex Fresnel integral correct to thirteen significant digits is tabulated at unit intervals in the argument. Author

N63-10430 Air Force Special Weapons Center, Kirtland AFB, N. Mex.

AN EARTH TRAJECTORY MODEL FOR SUBSURFACE BALLISTIC AND THRUSTED VEHICLES

Phyllis B. Chisholm, Robert M. Pelzl, and Francis L. Pugh Sept. 1962 60 p refs

(AFSWC-TDR-62-106)

A preliminary digital computer model is developed to describe the straight line motion of a body of revolution through the earth's subsurface. Drag forces resulting from soil displacement, time rate of soil strain, and kinetic friction are estimated. The following major assumptions are included: (1) the vehicle is a rigid undistorted body; (2) major drag contribution is from the vehicle nose; (3) homogeneous soil is subjected to plastic deformation; (4) total soil pressure due to soil displacement and velocity acts normal to the vehicle surface; and (5) any wave motion imparted to the soil is neglected. Drag components of normal pressure are integrated over the vehicle nose at each time instant and the resulting motion integrated with time to obtain trajectory predictions. Author

N63-10434 Columbia U., New York, N.Y.

ON COMPARING MULTINOMIAL PROBABILITIES

Ruth Z. Gold Brooks AFB, Tex., School of Aerospace Medicine, June 1962 16 p 8 refs

(SAM-62-81)

Two methods are presented for constructing simultaneous confidence intervals for linear functions of the unknown probabilities in independent sequences of multinomial trials. Both methods involve very simple calculations and are illustrated by examples taken from medical records. The first method permits an infinite number of intervals, while the second requires that their number be finite and that the particular linear functions be specified in advance. Both methods are asymptotic, and the properties of the intervals they yield hold in the limit. Thus, it can be said that the joint confidence coefficient in both cases tends to be at least $1 - \alpha$, where $1 - \alpha$ is the desired level of confidence, as the sample sizes increase indefinitely. J.R.C.

N63-10463 Rome Air Development Center. Advanced Studies Group, Griffiss AFB, N. Y.

PROPERTIES AND TRANSFORMATIONS OF SINGLE THRESHOLD ELEMENT FUNCTIONS

Irving J. Gabelman Oct. 1962 17 p 9 refs

(RADC-TDR-62-449)

A large number of Boolean functions may be realized as the output of a single threshold element; however, not all functions are so realizable. Those F_n which are, are said to belong to the class R. No easily applicable criteria have been formulated which enable an unequivocal determination to be made of whether a given $F_n \in R$. There are, however, certain transformations allowable on those $F_n \in R$ which exhibit a closure property, i.e., the transformation results in an $F_p \in R$. There are also certain properties of the form of $F_n \in R$ which can be recognized easily. A knowledge of these permissible transformations and observations of the form of a given F_n will, in many instances, allow for the desired determination. This paper examines those permissible transformations and properties of form. Author

N63-10476 Lincoln Lab., Mass. Inst. of Tech., Lexington

AN ACQUIRABLE CODE

Edwin Weiss and Daniel Gorenstein July 9, 1962 9 p 3 refs

(Contract AF 19(628)-500)

(Rept. 55G-2)

A mathematical procedure is presented for selecting an acquirable code to be used in range measurements for space vehicles. The procedure is based on the properties of maximal length shift register sequences and on the Chinese remainder theorem. Sequences of period in the billions can be handled without causing difficulties for the decoding computer. R.C.M.

N63-10491 Case Inst. of Tech. Engineering Design Center, Cleveland, Ohio

DESIGN SYNTHESIS IN A MULTIDIMENSIONAL SPACE WITH AUTOMATED MATERIAL SELECTION

Lucien A. Schmit, Jr., and Robert H. Mallett Aug. 1962 125 p 22 refs

(NASA Grant NsG-110-61)

OTS: $10.10 ph, $3.95 mf

This study employs an elementary structural system to demonstrate the feasibility of design synthesis in a multidimensional design space characterized by: (a) nine design parameter axes, (b) nonlinear inequality behavioral constraints, (c) linear inequality design parameter constraints, and (d) nonlinear merit function. An idealized automated material selection technique is included in the design synthesis capability. Author

N63-10497 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THEOREMS FOR CHANGE OF VOLUME AND MOMENTS OF VOLUME OF ELASTIC TANKS SUBJECT TO ARBITRARY INTERNAL PRESSURES

John R. Spreiter Repr. from J. Aerospace Sci., v. 29, no. 9, Sept. 1962 p 1140-1141 6 refs

Theorems are presented for simplifying the determination for the change of volume and moments of volume of elastic tanks subject to arbitrary internal pressures. A reciprocal theorem of Betti and Rayleigh is applied which relates two equilibrium states of an elastic body: one with displacement u_1 due to forces $p_1 dS$, the other with displacements u_2 due to forces $p_2 dS$. The reciprocal theorem states that the work done by the forces of the first set acting over the displacements produced by the second set is equal to the work done by the forces of the second set acting over the displacements of the first set. This theorem is used in presenting the other related theorems. J.R.C.

N63-10513 Army Missile Test and Evaluation Directorate, White Sands Missile Range, N. Mex.

MATRIX METHODS APPLIED TO THE GIBBSION VECTORS AND DYADICS WITH APPLICATIONS TO FLIGHT DYNAMICS

James S. Pappas Oct. 1962 63 p 30 refs

(Special Rept. 64)

Matrix methods applied to the vector, dyadic, and polyadic analysis of Gibbs' simplifies the transformations encountered in deriving mathematical models of dynamical systems in moving bases. The matrix methods eliminate the need for mentally tracking hordes of tedious indices. The techniques are applied to the derivation of equations of motion of flight systems in ortho-normal as well as non-ortho-normal moving bases. Author

N63-10521 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

NEWS OF THE ACADEMY OF SCIENCES SSSR, DEPARTMENT OF TECHNICAL SCIENCES, POWER ENGINEERING AND AUTOMATION (SELECTED ARTICLES)

V. S. Kulebakin, O. I. Larichev, V. D. Vershinin, and V. M. Kuntsevich Oct. 9, 1962 58 p 33 refs Transl. from Izvest. Akad. Nauk SSSR Otdel. Tekh. Nauk: Energetika i Avtomatika (Moscow), no. 5, 1961 p 7-12, 25-37, and 113-122
(FTD-TT-62-871/1+2)

CONTENTS:

1. ON POLYINVARIANCE IN AUTOMATIC CONTROL SYSTEMS V. S. Kulebakin and O. I. Larichev p 1-11 4 refs
2. ON INVARIANCE OF STABILIZATION AND REPRODUCTION SYSTEMS RELATIVE TO SEVERAL DISTURBANCES V. S. Kulebakin and V. D. Vershinin p 12-37 16 refs
3. ANALYSIS OF TRANSIENT AND STEADY-STATE PROCESSES IN PULSE-RELAY AND MINIMAX SYSTEMS WITH CONSTANT AND VARIABLE CONTROL PERIODS V. M. Kuntsevich p 38-55 13 refs

N63-10528 Stanford U. Applied Mathematics and Statistics Labs., Calif.

PROBABILITY INTEGRALS OF MULTIVARIATE NORMAL AND MULTIVARIATE

Shanti S. Gupta (Bell Telephone Labs.) Sept. 18, 1962 97 p 189 refs
(Contract Nonr-225(53))
(Tech. Rept. 64)

The evaluation of multivariate normal probability integrals is of special importance to the statistician dealing with multivariate problems. The joint distribution of several dependent continuous variates is often assumed to be a multivariate normal distribution, and the multivariate normal distribution also provides an approximation to the multinomial distribution for a large sample size. Applications of the multivariate normal distribution are numerous throughout statistical literature. An extensive list of applications of the bivariate normal probability distribution is given by D. B. Owen. The present paper gives a survey of the work on multivariate probability integral and related functions starting with the bivariate case and includes the author's recent work on the probability integrals of the multivariate normal and a multivariate analog of Student's t. Author

N63-10529 Stanford U. Applied Mathematics and Statistics Labs., Calif.

DURATION OF AN INTERRUPTED COUNTDOWN

Sidney I. Firstman (Rand Corp.) Sept. 27, 1962 34 p 1 ref
(Contract Nonr-225(53))
(Tech. Rept. 65)

A countdown could be interrupted by several kinds of problems, and, following each interruption, it could continue according to one of several policies; seven such policies are considered in this paper. The problem addressed is that of accounting for the randomly occurring problems and the time required to deal with them when estimating the distribution of interrupted countdown durations. The countdown is considered as an interrupted service process, and expressions are derived from which the moments of the interrupted countdown duration distribution can be obtained. The first two moments are derived explicitly. Author

N63-10538 Joint Publications Research Service, Washington, D.C.

PROBLEMS OF COMPUTER ENGINEERING

A. M. Novik, ed. Dec. 3, 1962 39 p 2 refs Transl. of three articles from Vopr. vychislitel'noy Tech. (Kiev), 1961 183 p
(JPRS-16490) OTS: $3.60

CONTENTS:

1. PROBLEMS OF COMPUTER ENGINEERING AND COMPUTER MATHEMATICS V. M. Glushkov p 1-10
2. COMPUTER ELEMENTS IN PERSPECTIVE L. A. Pil'kevich p 11-20 1 ref
3. RECOGNITION OF DIGITAL SYMBOLS Yu. T. Mitulinskiy p 21-36 1 ref

N63-10550 Illinois U. Coordinated Science Lab., Urbana

THE METHOD OF ADAPTIVE CONSTRAINED DESCENT

Stephen J. Kahne Oct. 1962 10 p 1 ref
(Contract DA-36-039-SC-85122)
(Rept. R-154)

The paper describes a method for determining a minimum of a scalar function of a vector variable. The vector variable may have vector inequality range constraints imposed. The technique ensures monotone descent and is known to be faster than the classical method of "steepest" descent in some cases. Moreover, it is not subject to the usual sensitivity problems which may arise using the steepest descent method. Author

21 METEOROLOGY

Includes: climatology; weather forecasting; lower atmosphere studies; and oceanography.

For related information see: 05 Astronomy and Astrophysics; 12 Geophysics; and 29 Space Sciences.

N63-10051 Deutsche Versuchsanstalt für Luft- und Raumfahrt. Inst. für Raumfahrtforschung, Porz (W. Germany)

INFORMATIVE UNTERSUCHUNGEN ÜBER ZWEI ELEKTRODENLOSE MFD-SYSTEME [INFORMATIVE STUDIES CONCERNING TWO ELECTRODELESS MFD SYSTEMS]

W. Peschka [1962] 27 p 6 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-12, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 56) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

Basic equations are set up for the steep current and migrating field generators. Results show an analogy between the transformer and the asynchronmachine. Trans. by I.V.L.

N63-10088 New York U. Washington Square Coll., N. Y.

A STUDY OF THE FAR INFRARED PROPERTIES OF CRYSTALS Final Scientific Report, September 1, 1957 to August 31, 1962

J. H. Rohrbaugh [1962] 10 p
(Contract AF 19(604)-2673)
(AFCRL-62-746)

This report covers the following: spectrometry, liquid dielectric measurements, magnetron harmonics, the isotope effect in a linear chain of NaCl, the Eigenfrequencies of NaCl at low temperatures, and the properties of the Echelette grating. J.R.C.

N63-10209 National Severe Storms Project, Kansas City, Mo.

DYNAMICS OF SEVERE CONVECTIVE STORMS

Chester W. Newton Washington, Weather Bureau, July 1962 49 p 110 refs Presented at the Symp. on Severe Local Storms, 201st National Meeting of the Am. Meteorol. Soc., Norman, Okla., Feb. 13-15, 1962 Preprint
(NSSP-9)

A review is presented, in very broad and qualitative terms, of the processes thought to be relevant to the storm as a motion system. Author

N63-10212 Washington U., Seattle

DETAILED ANALYSES OF SELECTED PACIFIC STORMS BASED ON CONTINUOUS RADAR RECORDS AND SHORT-INTERVAL SERIAL ASCENTS. VOL. V: CASE OF JUNE 5-7, 1961

071187 O - 63 - 5

Richard J. Reed July 1962 58 p 7 refs
(Contract AF 19(604)-5192)
(AFCRL-62-469)

Data and analyses are presented for the fifth and final case in the program of special radiosonde ascents. Included are original radiosonde records, pilot reports, continuous radarscope photographs, surface and upper-level analyses, and the Seattle time section for June 5 to 7, 1961. Author

N63-10277 Aerospace Information Div., Library of Congress, Washington, D. C.

CLOUD MODIFICATION FOR THE PREVENTION OR MITIGATION OF HAIL

Oct. 23, 1962 3 p 2 refs Review of: G. K. Sulakvelidze Physical principles of cloud treatment for the prevention of hail phenomena Doklady Akad. Nauk SSSR (Moscow), v. 144, no. 4, 1962 p 778-780
(AID-62-176) OTS: $1.10 ph, $0.80 mf

Two physically substantiated methods of preventing or mitigating hail by cloud modification are derived. The first method consists in the continuous crystallization of the entire large-droplet cloud zone, beginning at temperatures of -2° or -1° C. This method results either in the complete melting of the hailstones which have developed prior to the cloud modification or in a great duninution in the size of the hailstones in comparison with those that would have fallen in a natural course of events. The second method consists in creating a great number of large droplets at the base of the cloud in the initial stage of its development. By increasing the number of large particles serving as nuclei in the upper portion of the cloud, the mean diameters of these particles are decreased. The advantage of each method depends primarily on the height of the cloud base, the topography of the locality, etc. J.R.C.

N63-10499 Colorado State U., Fort Collins

THE ATMOSPHERIC MICRO-STRUCTURE AND ITS BEARING ON CLEAR-AIR TURBULENCE (CAT) A Preliminary Report

Elmar R. Reiter Oct. 1962 23 p 16 refs
(Contract N 189(188)55120A)
(Tech. Paper 39; CER62ERR62; NWRF 15-1062-069)

This report on atmospheric microstructure and its bearing on clear-air turbulence covers the following: photogrammetric cloud measurements, and a preliminary case study of clear-air turbulence. J.R.C.

N63-10541 Army Electronics Research and Development Activity. Missile Meteorology Div., White Sands Missile Range, N. Mex.

SOME ERRORS ASSOCIATED WITH ACOUSTICAL WIND MEASUREMENTS THROUGH A LAYER

John W. Coffman and Robert G. Price Oct. 1962 17 p 4 refs
(SELWS-M-12)

An acoustic wind measuring array consisting of a transmitter and two receivers is investigated. The error incurred by assuming that the wind component in the line of sensors is dependent solely on the time delay of the sound front arrival at the two receivers is found. For an orientation suitable for measuring the horizontal flow through a layer, the error is less than 7 percent for cross-wind components less than 30 mph and the temperature through the layer known to ±1° C. Author

N63-10575 Pennsylvania State U. Coll. of Mineral Industries, University Park

DATA ACCURACIES AND WEIGHTING FACTORS AT 50 MILLIBARS Scientific Report No. 1

John Bruce Hovermale July 1962 62 p 31 refs
(Contract AF 19(604)-7261)
(AFCRL-62-896)

The accuracy of various types of 50 mb data is evaluated. The estimation of standard errors is made, for the most part, without specifying true values. The relative importance of the various types of data is then expressed in numerical form. Extrapolated data are shown to be of great relative value in synoptic analysis at 50 mb. Extrapolation by use of persistence seems to be the best means of supplying additional data in most cases. A question is raised as to validity of previous height error estimates in the stratosphere. Author

22 NAVIGATION AND GUIDANCE

Includes: autopilots; star tracking; inertial platforms; and traffic control.

For related information see: 06 Auxiliary Systems; 08 Communications; 09 Electronics; 10 Facilities; 15 Instrumentation; 20 Mathematics; and 29 Space Sciences.

N63-10019 Deutsche Forschungsanstalt für Luft- und Raumfahrt. Inst. fur Strahltriebwerke, Brunswick (W. Germany)

DIE DARSTELLUNG VON VERBRENNUNGS- UND DETONATIONSVORGÄNGEN IM P,W-DIAGRAMM [PREPARATION OF COMBUSTION AND DETONATION FUNDAMENTALS IN THE P,W-DIAGRAM]

W. Alvermann 1962 11 p In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-11, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 21) Available from WGL, Friedrich Vieweg & Son Burgplatz 1, Brunswick, W. Germany

The p,w-diagram is a simple method of representing heat increase and heat transport for subsonic and supersonic velocities. The well known Hugoniot-Curve portion of the Rankine-Hugoniot representation (strong detonation, weak detonation, weak deflagration, strong deflagration) is shown to lie within and without the adiabatic region, which, at times, is subdivided by one of the critical condition-indicating lines, to which the Chapman-Jouget point corresponds. The p,w-representation also permits the possibility of representing the oblique impact preceding combusion. Conditions which appear in the so-called "detonative ram jet engine", in which the mixture is ignited in an oblique compression stroke are described. A.S.

N63-10032 Technische Hochschule Stuttgart. Inst. für Flugnavigation (W. Germany)

DIE AUTOMATISCHE KOPPELKARTE AK3J, EINE NEUE NAVIGATIONSHILFE FÜR FLUGZEUGE OHNE NAVIGATEUR [THE AUTOMATIC COUPLING CHART AK3J, A NEW NAVIGATION AID FOR AIRPLANES WITHOUT NAVIGATOR]

Karl Ramsayer Aug. 3, 1962 22 p In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-12, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 36) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

A new instrument, the Automatic Coupling Chart AK3J, has been devised to perform the functions of dead reckoning and navigation for unmanned flight by integrating them with the principles of inertial guidance. This device has been worked out by the Institute of Flight Navigation of the Stuttgart Institute of Technology. By combining the inertial impulses with the conventional navigational methods, the instrument positions the aircraft exactly on the chart and provides other data derived from the calculations of speed versus acceleration for other navigational information. The purpose of this

new construction is to provide: (1) the most universal possible combination of all navigational aids into one unified instrument; (2) exact positioning on the chart; and (3) calibration of the accuracy of the conventional methods with the precision of the Doppler and inertial navigational systems. M.B.S.

N63-10033 Perkin-Elmer and Co. G.m.b.H. Bodenseewerke, Überlingen (W. Germany)

UNTERSUCHUNG DES ARBEITSVERFAHRENS EINES FLUGREGLERS UNTER BERÜCKSICHTIGUNG DES NICHTLINEAREN VERHALTENS DES STELLMOTORS [INVESTIGATION OF THE MODE OF OPERATION OF A FLIGHT REGULATOR WITH REGARD TO THE NONLINEAR CONDUCT OF THE REGULATING MOTOR]

Ernst Lonn Sept. 6, 1962 15 p In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-12, 1962

(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 37) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

This investigation indicated a change of the control signal whereby a second differential coefficient of the azimuth was introduced. The PID gyroscope was capable of generating the proper measurement transmitter for producing this desired signal. Revised equations for the control signal indicated less demand on the regulating motor and made possible the control of a large compression area without changing the cutoff factors. Trans. by I.v.L.

N63-10034 Deutsche Versuchsanstalt für Luft- und Raumfahrt. Inst. für Steuer- und Regeltechnik, Oberpfaffenhofen (W. Germany)

DIE STABILITÄT VON ABTAST-REGELKREISEN [THE STABILITY OF SAMPLING-TYPE CONTROL CIRCUITS]

Jürgen Ackermann Aug. 1962 15 p 14 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-12, 1962

(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 38) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

A mathematical analysis of the sampling process and the stability conditions for sampling systems is given. An approximation method is explained, which makes clear several fundamental relationships found in sampling systems. The document includes circuit diagrams, plotted curves, block diagrams, and mathematical formulas. A.S.

N63-10035 Deutsche Versuchsanstalt für Luft- und Raumfahrt. Inst. für Steuer- und Regeltechnik, Oberpfaffenhofen (W. Germany)

ÜBER NAVIGATIONSFEHLER DER TRÄGHEITSLENKUNG VON SATELLITEN-TRÄGERRAKETEN [ON NAVIGATION ERRORS OF THE INERTIAL GUIDANCE OF SATELLITE CARRIER ROCKETS]

Artur Brust Aug. 1962 30 p 3 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-12, 1962

(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No 39) Available from Friedrich Vieweg & Son, Burgplatz 1, Burnswick, W. Germany

The course of theoretical acceleration for the path of ascent of a satellite with a total burning period of 700 sec. at an orbit altitude of 440 km. is presented. The following values are given for the coefficients of error:

zero point error	$\epsilon_1 = 10^{-3}$ m/sec^2
scale error	$\epsilon_2 = 10^{-4}$
platform inclination	$\epsilon_3 = 10^{-4}$ rad
gyroscopic drift	$\epsilon_4 = 10^{-7}$ rad/sec^2

Graphs are presented for the errors of angle, altitude, velocity, and orbital inclination according to the Schuler system. Results of this study indicated gyroscopic drift to be of primary importance and that a reduction of this error would result in an effective reduction in total error. Trans by I.v.L.

N63-10053 Deutsche Versuchsanstalt für Luft- und Raumfahrt. Inst. für Luftstrahlantriebe, Porz-Wahn (W. Germany)

ÜBER DIE VERDAMPFUNG VON TROPFEN IN ZWEI PHASEN—VORLÄUFIGE FASSUNG [ON THE VAPORIZATION OF DROPS IN TWO PHASES—PRELIMINARY VERSION]

J. Krengel Sept. 1962 19 p 15 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-12, 1962

(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 58) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

The process of mixture preparation on combustion chambers of jet engines is studied. After successful dispersion, some particles vaporize somewhat in the still nonreactive gas mixture surrounding them before they reach the combustion zone or are themselves ignited. It is, however, conceivable that some drops may cross a reactive gas mixture without a flame front building up around them. The experiments carried out by the Institute for Air-jet Engines were concerned with the vaporization of individual droplets by means of forced convection. The work on two-phase vaporization reported in this paper was done with benzol, n-hexan and n-heptan. A.S.

N63-10098 Army Transportation Engineering Agency, Ft. Eustis, Va.

A COMPARISON OF SHOCK AND VIBRATION FOR AIR, RAIL, SEA AND HIGHWAY TRANSPORTATION

Robert Kennedy [1962] 20 p To be presented at the 31st Shock and Vibration Symposium, Oct. 3, 1962

A long-range program has been initiated and is now in progress to study the shock and vibration environments occasioned on cargoes, particularly Army sensitive cargoes, by all modes of transportation. Data are being collected concurrently for highway, rail, air, and ocean shipping. The first efforts in the program have shown both some similarities and many basic differences among the modes of transportation as regards shock and vibration measured data. Perhaps the largest difference occurs with the time involved in both the shocks and the vibrations. When the vibrations transmitted to the cargo by all modes of transportation are analyzed, it is seen that the basic measured frequency has varied from 1,000 cycles per second to 0.25 cycle per second. It was decided that some of the preliminary results, covering a sampling of the environment from each mode, should be studied prior to the pursuit of the remainder of the program. The purpose of this paper is to present the original findings in the program—to give a broad idea of the nature of the initial data and the general plan for the rest of the program. Also included are a general discussion of the instruments and data methods used in the program to date. Author

N63-10108 Collins Radio Co., Dallas Div., Tex.

4-WHEELS MODERNIZATION Final [Engineering] Report

R. W. Wollan and R. Trcka Nov. 1, 1962 58 p 23 refs (AF 19(604)-8019, Phase III) (CER-D1489; AFCRL-62-744)

Study programs covering the major areas of importance were conducted to update the "4 wheels" air-transportable, air traffic control system. These studies aided Air Force personnel in writing military specifications for an augmented 4-wheels system. The initial studies covered only those areas considered at the time to be critical to the development of the augmented system. This report covers some of the areas not covered in the earlier studies. Intercommunications, low-frequency beacon, control tower, weather facility, and teletypewriter control center are the major items covered. Author

N63-10201 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio

SAMPLING STUDIES DOWNSTREAM OF HYDROGEN-NITROUS OXIDE-DILUENT FLAMES

Burton D. Fine Washington, NASA, Nov. 1962 22 p 11 refs (NASA TN D-1528) OTS: $0.75

Composition profiles were measured in the burned gas downstream of rich and lean hydrogen-nitrous oxide flat flames diluted with nitrogen, argon, and air. It was proposed that the nitric oxide found downstream of rich flames was formed by the reaction $N_2O + H \rightarrow NO + NH$ in the flame itself. Results for lean flames, based on the rates of decay of N_2O and the accumulation of NO, indicated that the reaction $N_2O + O \rightarrow 2NO$ is about 20 times slower than $N_2O + O \rightarrow N_2 + O_2$ and has an activation energy considerably less than 30 kcal. The effect of thermal decomposition of N_2O was negligible in the downstream zone but was important within the flame itself. Author

N63-10298 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

PROBLEMS OF AUTOMATIC CONTROL OF MOVING OBJECTS (SELECTED ARTICLES)

Sept. 28, 1962 47 p 7 refs Transl. from Voprosy Avtomaticheskogo Regulirovaniya Dvizhushchikhsys Ob'yektov, Aviatsionnyy Inst., Trudy 139 Moscow, 1961 p 71-86, 87-107 (FTD-TT-62-1073/1+2)

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2. CONCERNING THE DYNAMIC ERROR OF AUTOMATIC LONGITUDINAL STABILIZATION OF A WINGED AIRCRAFT IN A DISTURBED ATMOSPHERE F. A. Mikhaylov and V. M. Stromilov p 20-44 4 refs (See N63-102300)

N63-10299 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

SELF-OSCILLATIONS OF A NEUTRAL AIRCRAFT WITH AN AUTOPILOT HAVING A PULSE-ACTION SERVOMECHANISM

S. M. Alferov Trudy 139 *In its* Problems of Automatic Control of Moving Objects, Trudy 139 Moscow, 1961 p 1-19 3 refs (See N63-10298 01-22)

A study is made of the self-oscillations of a neutral aircraft with an autopilot having a pulse-action servomechanism. It is indicated that the existence condition for self-oscillations in a pulse servomechanism is satisfaction of the inequality $ft_M/2 > \epsilon$, where ϵ is the dead zone, f is the maximum control surface rate, and t_i is the duration of the first-pulse element pulse. When the pulse servomechanism is an autopilot element, the self-oscillations inherent to the pulse servomechanism are also retained in the aircraft-autopilot system. J.R.C.

N63-10300 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

CONCERNING THE DYNAMIC ERROR OF AUTOMATIC LONGITUDINAL STABILIZATION OF A WINGED AIRCRAFT IN A DISTURBED ATMOSPHERE

F. A. Mikhaylov and V. M. Stromilov *In its* Problems of Automatic Control of Moving Objects, Trudy 139 Moscow, 1961 p 20-44 4 refs (See N63-10298 01-22)

A study of the dynamic error of automatic longitudinal stabilization of a winged aircraft in a disturbed atmosphere covers the following: the general equations of longitudinal motion; linearization of equations of motion; reduction of equations of motion to dimensionless form; transfer functions of uncontrolled aircraft with respect to wind disturbances; automatic stabilization of flight; conditions for ideal dynamic flight stability and the possibility of achieving them; operating principle of the autopilot and its transfer function; transfer functions characterizing response of controlled aircraft to wind disturbances; estimation of error of longitudinal stabilization of aircraft for random wind disturbances; error of longitudinal stabilization with uncorrelated steady-state random wind disturbances; degree of longitudinal mobility of aircraft; and the method of determining degree of longitudinal mobility of aircrafts from the coefficients of the transfer function. J.R.C.

N63-10391 Space Technology Labs., Inc., Redondo Beach, Calif.

CONTROL OF RE-ENTRY FROM ORBIT

M. J. Friedenthal *In* Air Force Systems Command. Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif. Transactions of the 7th Symp. on Ballistic Missile and Space Technol., U.S. Air Force Academy, Colo., Aug. 13-16, 1962 Vol. II p 33-87 39 refs (See N63-10389 01-01) (Contract AF 04(647)-619)

The return from an earth orbit is characterized by three phases: Deflection from orbit, reentry flight within the atmosphere, and a terminal phase. Deflection from a circular orbit by propulsive deboost is treated. The characteristics of the flight path at reentry are described in terms of the orbital and deboost parameters. Error coefficients are presented to show the significance of the various parameters of the deboost process. The extension of the analysis to elliptical orbits is indicated. Atmospheric flight considerations are discussed. Terminal guidance for the precise control of the landing point is described. A bibliography on the control of reentry from orbit is included. Author

N63-10446 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

THE SUPPRESION OF SELF-OSCILLATIONS IN A SERVOPILOT SYSTEM

Yu. A. Gopp Sept. 5, 1962 12 p 6 refs Transl. of Izv. Vysshikh Uchebn. Zavedenii, Mashinostro, no. 5, 1961 p 26-32 (FTD-TT-62-876/1+2+4)

By combining the method of harmonic balance with D-decomposition operations, a zone is isolated in which it is possible to develop self-oscillations. The influence of the parameters of the system and of the pulses with respect to the derivative of the deformation of these zones is shown. The possibility of suppressing self-oscillations by introducing compensating nonlinearity is explained. In making the technical calculation, consideration is given to the sliding of the object, the imperfection of the differentiators, the inertia of the amplifiers, etc. This makes the method more broadly applicable. Author

N63-10455 Weapons Research Establishment (Australia)

A MATHEMATICAL MODEL OF A THREE-AXIS STABILIZED PLATFORM

G. E. Beltrame June 1962 36 p 6 refs (Tech. Note SAD-93)

Equations are derived for describing the dynamic behavior of a three-axis stabilized platform as used in the inertial navigator of an inertially-guided vehicle. The (hypothetical) platform selected for analysis is stabilized by three single-degree-of-freedom rate-integrating gyros whose outputs to go geared servo motors which control the motion of the gimbals. The system considered does not include a redundant gimbal; it corresponds, therefore, to an application in which the maximum maneuver of the vehicle is limited to avoid gimbal lock. This model of the three-axis stabilized platform is derived by first considering the equations for a platform stabilized about only one axis. Author

23 PHYSICS, GENERAL

Includes: acoustics; cryogenics; optics; and thermodynamics.

For astrophysics see: 05 Astronomy and Astrophysics.

For related information see: 12 Geophysics; 29 Space Sciences; 24 Physics, Plasma; and 24 Physics, Solid-State.

N63-10047 Deutsche Forschungsanstalt für Luft- and Raumfahrt. Inst. für Strahltriebwerke, Brunswick (W. Germany)

ÜBER AKUSTISCHE NAHFELDER VON TRIEBWERKSSTRAHLEN [ON ACOUSTICAL FIELDS IN THE PROXIMITY OF ENGINE JET-STREAMS]

H. Dahlen 1962 9 p 7 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9-11, 1962

(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 52) Available from WGL, Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

The complicated problem of annoyance to inhabitants caused by the jet noises of military and civilian jet planes landing and taking off has had added to it a second aspect, mechanical loading. This problem may even reach proportions in which the destruction of aircraft and rocket cells by acoustical oscillations in the vicinity of engine jetstreams is possible. Dealing with these problems has been especially difficult because, until now, no one had formulated or described a theory to explain these acoustical fields. Experimental studies were not practical because of high operation costs and the high sound pressures required. A happy medium has been found in the resemblance of dynamic principles to acoustical principles. By employment of this dynamic resemblance and by the use of models it is now possible to answer some of the questions. This paper describes these efforts and states that the findings indicate that it is also possible to carry out theoretical computations in the complex proximity fields of engine jetstreams. The still great insecurity with respect to damage to rocket cells requires further theoretical and experimental efforts in this domain. A.S.

N63-10070 Midwestern Universities Research Association, Madison, Wis.

THE EXCITATION OF A CIRCULAR CYLINDRICAL CAVITY BY A CIRCULAR WAVEGUIDE

C. Bjerke and J. Van Bladel July 20, 1962 21 p 3 refs

(Contract AT(11-1)-384)

(MURA-644) OTS: $0.50

The problem of determining the pressure in a circular cylindrical cavity of radius b connected to a circular input waveguide of radius a is formulated in terms of an integral equation. Values of the reflection coefficient in the guide and of the pressure in the cavity are given in terms of the frequency and of the dimensionless ratio a/b. The problem of the cavity with an input and an output waveguide is also analyzed, and values of the transmission coefficient are obtained. Author

N63-10071 Midwestern Universities Research Association, Madison, Wis.

COMPUTER PROGRAM FOR BEAM TRANSPORT PROBLEMS

D. A. Swenson July 20, 1962 19 p

(Contract AT(11-1)-384)

(MURA-645) OTS: $0.50

This report describes a computer program, entitled BEAM TRANSPORT, which was written to facilitate the study of beam transport systems. The program was written in Fortran for an IBM 704 computer with a 32K fast memory and at least one tape unit. The program simulates the action of each element of a beam transport system on a group of charged particles representing a beam. The high speed and flexibility of this approach provides a powerful tool for the design of transport systems. The performance of many "imperfect" systems in the process can be evaluated by adjusting the parameters of the transport system to obtain a more satisfactory one. Author

N63-10093 Brown U., Providence, R. I.

A RELATIVE DETERMINATION OF THE VISCOSITY OF SEVERAL GASES BY THE OSCILLATING DISK METHOD

J. Kestin and J. H. Whitelaw Sept. 1962 49 p 21 refs Prepared for journal publication

(Contract Nonr-1858(25); Proj. Squid)

(Tech. Rept. BRN-2-P)

New measurements are reported of the viscosity of argon, carbon dioxide, helium, neon and nitrogen in the range of temperatures 25° to 270° C and in the range of pressures 1 to 150 atm. The measurements are relative to nitrogen at 22° C; they have been performed by the use of an oscillating-disk viscometer. The paper provides empirical correlations and correlations based on the use of a Lennard-Jones 6 - 12 and a Buckingham exp - 6 potential. Except for helium, either potential gives a reasonable fit; in the case of helium, the fit provided by the exp - 6 potential is preferable. Author

N63-10115 California U., Livermore. Lawrence Radiation Lab.

THE CERENKOV RESPONSE OF LUCITE AND QUARTZ TO GAMMA AND FAST NEUTRON RADIATION

J. E. Doyle and W. C. Dickinson July 5, 1962 31 p 7 refs

(Contract W-7405-eng-48)

(UCRL-7032) OTS: $0.50

Experiments have been conducted to evaluate the effectiveness of Lucite and quartz as Cerenkov materials for gast gamma detectors. The relevant theory is presented as an aid in interpreting and extrapolating the experimental results. It is found that Lucite is a satisfactory Cerenkov material, showing negligible luminescence and good discrimination against neutrons relative to the LRL plastic fluor. Author

N63-10120 National Physical Lab. of Israel, Jerusalem

RESEARCH ON OPTICS OF SELECTIVE SURFACES Second Annual Report, 1 Sept. 1960-31 Mar. 1962

H. Tabor [1962] 36 p 9 refs

(Contract AF 61(052)-279)

(AFCRL-62-1045)

Chemical, optical, and mathematical investigations of thin absorbing films on metal substrates intended for solar energy absorbers are described. Author

N63-10121 Israel Inst. of Tech., Haifa

YIELD AND ANGULAR DISTRIBUTION OF CERENKOV RADIATION FROM EXTENSIVE AIR SHOWERS Technical Note No. 5

Henry Kasha, Yona Oren, and Kurt Sitte July 1, 1962 11 p 1 ref Presented at the Inter-American Cosmic-Ray Conference, La Paz, Bolivia, July 1962

(Contract AF 61(052)-196)

(AFCRL-62-1046)

The relative yield of Cerenkov radiation from extensive air showers and its angular distribution were measured as a function of the shower size in the range 4×10^4 to 2×10^6 particles. It was found that the larger showers are not as efficient in producing Cerenkov light signals as the smaller ones. The effect can be understood in light of the results on the angular distribution of Cerenkov radiation near the shower axis which was found to be more peaked forwards in larger showers. This result also leads to the conclusion that the angular distribution of electrons with energy >.21 Mev near the axis of EAS is dependent on the shower size. Author

N63-10123 Queen's U., Belfast (Gt. Brit.)

ISOTOPE SHIFT IN Li AND B^{2+}

M. R. Flannery and A. L. Stewart [1962] 13 p 8 refs

(Grant AF-EOARDC 61-16)

(AFCRL-62-1065)

The mass polarization or specific isotope shift of the $1s^2\ 2s\ ^2S$ and $1S^2\ 2p\ ^2P$ levels of Li and B^{2+} is calculated using open-shell type wave functions and the shifts of the resonance lines of Li_7 relative to Li_6 and of B^{11+}_{11} relative to B^{11+}_{10} are estimated to be 0·100 cm^{-1} and

0·688 cm^{-1}, respectively, compared with the observed values 0·157 cm^{-1} and $\left.\begin{matrix}0{\cdot}970\ \Delta J=1\\0{\cdot}930\ \Delta J=0\end{matrix}\right\}cm^{-1}$. The results are also compared with the values obtained using an alternative form of the mass polarization operator. Author

N63-10129 ITT Federal Labs., San Fernando, Calif.
AN ANALYTICAL AND EXPERIMENTAL STUDY CONCERNING AN INFRARED IMAGE CONVERTER SYSTEM FOR OBSERVATION BY MEANS OF THE SEQUENTIAL LIGHT AMPLIFICATION SYSTEM [Report for Period April 16, 1958-Jan. 31, 1960]
F. F. Hall, Jr., R. K. Orthuber, et al Wright-Patterson AFB, Ohio, Aeronautical Research Labs., Aug. 1962 181 p 71 refs
(Contract AF 33(616)-5626)
(ARL-62-411; supersedes WADD-TR-60-152)

The sensitivity of edgegraph image converters used in conjunction with a contrast enhancing sequential light amplifier is derived and compared with observation using the unaided eye. Both transmission and low reflectance type edgegraph films are considered. It is shown that the use of electronic contrast enhancement substantially improves the minimum detectable temperature difference for such devices. The ultimate sensitivity using available films and light sources is equivalent to temperature contrasts of well less than 1° C in the object scene. Experimental data on the optical constants of selenium, lead chloride, and lead bromide in the region of their absorption edges are given. Low reflectance films with R = 0.002 are described and the methods for production detailed. Various attempts to obtain intense, highly stable light sources, and associated filters are reported. Tests made at ARL with a transmission edgegraph converter and an available "Cat-Eye" light amplifier are described. The minimum detectable temperature difference of several hundred degrees is shown to be due to excessive bandwidth and lack of dynamic response in the chain. Author

N63-10141 California U., Berkeley. Lawrence Radiation Lab.
CONTROLLED THERMONUCLEAR RESEARCH. Semiannual Report Jan. through June 1962
C. M. Van Atta et al July 20, 1962 119 p 100 refs
(Contract W-7405-eng-48)
(UCRL-10294) OTS: $2.50

Controlled thermonuclear research included the following: experimental investigation of the stable and unstable modes of plasma confinement in the Table Top magnetic-compression mirror machine; construction and initial operation of the Alice energetic neutral-atom injection mirror machine; rebuilding of the pulsed-field coil system of the Toy Top multiple-compression machine; analytical derivation of a self-consistent solution for the distribution of electrons in an infinitely thin Astron E layer; classification of instabilities predicted by the finite-conductivity theory of plasma stability under three categories: a long-wave "tearing mode," a short-wave "rippling mode," and a low-pressure interchange mode; studies on plasma confinement in a bumpy torus type of field; operation of a newly designed device, Homopolar V; reduction of turbulence previously observed in Hothouse 11 (ion cyclotron heating); Alfvén waves; and extension of the instability of the positive column discharge in a longitudinal magnetic field to an alternating applied electric field. B.J.C.

N63-10146 Air Force Cambridge Research Labs., Bedford, Mass.
A SHORT SURVEY OF RECENT NUCLEAR REACTION EXPERIMENTS EMPLOYING 1-3 MEV PARTICLE ACCELERATORS Research Report
E. F. Kennedy June 1962 38 p 178 refs
(AFCRL-62-162)

A short survey is presented of the nuclear physics experiments which were performed recently, using particle accelerators similar to the 3-Mev positive or negative polarity Van de Graaff accelerator. Author

N63-10150 Directorate of Materials and Processes, Aeronautical Systems Div., Wright-Patterson AFB, Ohio
OBSERVATION OF MAGNETIC DOMAINS BY MEANS OF THE KERR EFFECT [Final Report, July 1961-Mar. 1962]
Axel M. Stoffel and Karl J. Strnat Sept. 1962 19 p 12 refs
(ASD-TDR-62-683)

An experimental apparatus has been built which employs the magneto-optical Kerr effect for visual observation and photographic recording of magnetic domain patterns. A discussion is presented of the Kerr effect and its application to the study of magnetic domains and an analysis is made of some of the optical problems incurred in this application. It described the experimental set-up and presents pictures of domain structures observed. Author

N63-10158 General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.
CRITICAL HEAT FLUX AND FLOW PATTERN CHARACTERISTICS OF HIGH PRESSURE BOILING WATER IN FORCED CONVECTION
Frank E. Tippets Washington, AEC Div. of Tech. Information, Apr. 1962 247 p 109 refs
(Contract AT(04-3)-189, P. A. 11)
(GEAP-3766) OTS: $3.00

High-speed motion pictures of boiling-water flow patterns in conditions of forced flow at 1000 psia pressure in a vertical heated rectangular channel were taken over the range of mass velocities from 50 to 400 lbs/sec-ft², fluid states from 170 Btu/lb bulk enthalpy of subcooling to 0.66 bulk steam quality, and heat fluxes up to, and including, the critical heat flux level. Thirty-three sequences from the motion pictures, covering this range of variables, have been made up in suitable form for further study. The motion pictures show substantial, but not indisputable, evidence that the general arrangement of the flow, in conditions of bulk boiling, at heat fluxes near and including the critical heat flux level, is characteristically a wavy, turbulent liquid film, in which there is vapor formation, flowing along the channel walls with the balance of the liquid being carried as either dispersed droplets or as an emulsion with the vapor in an adjacent more rapidly and steadily moving core. Author

N63-10159 California U., Riverside
SPIN WAVE-ELECTRON INTERACTIONS IN MAGNETIC SOLIDS Technical Report 1
Thomas Wolfram (Ph.D. Thesis) Aug. 1962 154 p 95 refs
(Contracts AFOSR 61-70 and AFOSR 62-318)

The formal theory of spin waves in ferro- and antiferromagnetic insulators is reviewed with emphasis on the assumptions necessary to justify the theory. Some recent experiments which have established the existence of the spin wave and its associated quantum of energy, the magnon, are discussed. Slater's band theory of spin waves in insulators and its generalization by Edwards to ferromagnetic metals is considered in detail. It is concluded that the band-type states interact dynamically with the spin wave states. Author

N63-10235 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TRANSPORT PROPERTIES OF GASES
Williard E. Meador, Jr. *In* Virginia Polytechnic Inst., Blacksburg. Reentry Dynamics, Part II. Proc. of the Conf. on Physics of the Solar System and Reentry Dynamics, July 31 to Aug. 11, 1961 p 108-119 37 refs (See N63-10230 01-01) VPI: $2.00

It is shown that, in contrast to the fairly satisfactory state of knowledge of the equilibrium thermodynamic properties of high temperature gases, there is a serious lack of reliable experimental and theoretical information on transport coefficients. Some of the problems mentioned include: (1) Limitations of the Chapman-Enskog theory (a perturbation solution of the Boltzmann equation, using the ordinary Maxwellian distribution as the zero-order term, which

predicts such second-order effects as thermal diffusion, etc.). (2) Scarcity of good potential functions for use in the evaluation of Hirschfelder collision integrals. (3) Almost complete inadequacy of electron-atom treatments. Author

N63-10247 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
PHYSICAL INTERPRETATION OF THE EXTRA SOLUTIONS OF THE DIRAC EQUATION FOR STRONGLY COUPLED YUKAWA POTENTIALS
P. B. Burt and W. K. R. Watson Sept. 10, 1962 9 p 3 refs
(NASA Contract NAS7-100)
(JPL-TR-32-341) OTS: $1.10 ph, $0.80 mf

It is shown that extra solutions of the Dirac equation become acceptable when the dimensionless coupling constant γ^2 becomes greater than 3/4. The physical interpretation of these solutions is examined in the light of Regge's hypothesis regarding angular momentum, and their possible interest for the relativistic scattering problem is indicated. Author

N63-10280 California U., Berkeley
THE FREE ELECTRONS IN ACTIVE NITROGEN
W. B. Kunkel and A. L. Gardner Wright-Patterson AFB, Ohio, Aeronautical Research Labs., Aug. 1962 28 p 23 refs
(Contract AF 33(616)-6161)
(ARL-62-404)

The resonance shift in an S-band cavity was used to measure the free-electron density [n] in a continuous flow of rf excited active nitrogen in the mm Hg pressure range. [n] varied between 10^7 and 6×10^9 cm^{-3}, and depended distinctly on the oxygen contamination. The ions formed presumably are NO^+. By admixing known small amounts of nitric oxide to the stream, it could be demonstrated that the ionization rate indeed varied linearly with the amount of NO added. At high pressures and large [n] the electron removal was by recombination, and at low pressures and small [n] it was governed by ambipolar diffusion. The value of Dp/α was estimated at 10^9mm Hg/cm. Since the NO must be practically completely dissociated by the active nitrogen, the required large ionization rate indicates that the mechanism probably involves formation of excited nitrogen molecules as an intermediate step. Author

N63-10281 Watertown Arsenal. Materials Research Lab., Mass.
IMAGE OF THE FERMI SURFACE IN LEAD
A. Paskin and R. J. Weiss Sept. 1962 7 p 3 refs
(MRL-124)

A search was made for the Kohn anomalies in Pb by measuring the thermal diffuse scattering of X-rays. Anomalies were found in accord with the neutron measurements of Brockhouse and co-workers. The anomalies are somewhat different from the free electron values. The anomalies seem to be associated with only longitudinal modes of vibration. The measurements were hindered by spurious diffraction peaks arising from an oxide surface or regions of polycrystallinity. Author

N63-10302 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio
DEFORMATION OF A TRAVELLING MAGNETIC FIELD UNDER THE SURFACE OF A CONDUCTIVE MEDIUM
Jaroslav Schilder Sept. 27, 1962 34 p 4 refs Transl. from Elektrotechnicky Casopis, no. 5, 1961 p 287-309
(FTD-TT-62-981/1+2)

The purpose of this report is to objectively explain two types of deformations of nonhomogeneous magnetic fields occurring in electric installations, which originate under a conductive medium as a result of mutual movement of the field toward the center. The first type of deformation is derived from the problem taking place, for example, in rotors of asynchronous motors formed by a massive roller (cylinder). The shape of the magnetic field in the rotor under the influence of relative movement of the conductive medium toward the field becomes deformed in such a way, making it look as if this field was pulled down by the center of the rotor. The other type of deformation originates in magnetic fields moving in magnetic circuits made up of plate connections, as, for example in yokes of alternating electric machines. The main traits (characteristics) of this deformation, using models with simple shape of field, are explained. Author

N63-10325 California U., Los Angeles
ON THE USE OF PIEZOELECTRIC-MAGNETOSTRICTIVE COUPLING IN DIGITAL DEVICES
Arthur A. Borsei (Ph.D. Thesis) Aug. 1962 461 p 101 refs
(Contract Nonr-233(52))
(Rept. 62-37)

A study of the use of piezoelectric-magnetostrictive coupling in digital devices includes the following: static magnetic behavior of magnetostrictive thin films; dynamic behavior of magnetostrictive thin films; dynamic behavior of magnetostrictive thin films; and piezoelectric crystals and piezoelectric-magnetostrictive coupling. J.R.C.

N63-10349 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio
BREMSSTRAHLUNG SPECTRUM OF 260-MEV ELECTRONS
Yu. M. Ado, K. A. Belovintsev, et al Sept. 12, 1962 12 p 14 refs
Transl. from Atomnaya Energ. (Moscow), v. 12, no. 3, 1962 p 193-197
(FTD-TT-62-1174/1+2+4)

The bremsstrahlung spectrum of 260-mev electrons has been measured experimentally with a 15-channel pair γ-spectrometer. A considerable difference was observed between the experimental spectrum and Schiff's spectrum in the region of near-maximal photon energies. It has been shown that for thick targets of $\sim$0.10 radiation units and thicker, it is necessary to take into account multiple photon radiation by a single electron. Author

N63-10356 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio
TEMPERATURE FIELD OF A LIMITED BODY, HAVING THE FORM OF A PARALLELEPIPED WITH CONTINUOUSLY ACTIVE SOURCE OF HEAT
I. G. Alyamovskiy Oct. 8, 1962 6 p 1 ref Transl. from Tezisy Dokladov i Soobshcheniy Na Soveshchanii Po Teplo i Massobmenu [Theses of reports and communications from the Conference on Heat and Mass Exchange] Minsk, June 5-9, 1961 p 1-7
(FTD-TT-62-1391/1+2)

A method is given for solving the heat exchanger problem for the case of the temperature field of a plate of finite dimensions with a continuously acting heat source. The plate is assumed to have finite dimensions $2R_1 \cdot 2R_2 \cdot 2R_3$ (parallelepiped) with temperature t_0 placed in a medium with constant temperature t_c t_0. The active heat source in the plate has a specific power which changes in accordance with the exponential law. Heat is exchanged with the surrounding medium by the law of convection. Formulas are given for determining the temperature distribution in the plate at any moment of time. R.C.M.

N63-10360 Hanford Atomic Products Operation, Richland, Wash.
QUASI-ELASTIC SCATTERING BY ROOM TEMPERATURE LIGHT WATER
D. A. Kottwitz, B. R. Leonard, Jr., and R. B. Smith Oct. 1962 17 p 17 refs
(Contract AT(45-1)-1350)
(HW-75147) OTS: $0.50

The energy width and integrated intensity of the quasi-elastic scattering peak of light water at 22 C have been measured on

the Hanford triple-axis crystal spectrometer at a number of scattering angles for neutrons of energy 0.10, 0.15, and 0.25 ev. The energy resolution was 7, 11, and 10 percent, respectively. Wave-vector transfers ranged from 1 to 7A^{-1}. The quasi-elastic peak was assumed to have a Lorentzian shape in correcting the observed peaks for resolution. When plotted versus the square of the wave-vector transfer, both the corrected line width and integrated intensity exhibit systematic differences correlated with the energy of the neutrons used. In general, the present widths are greater than those obtained with cold and thermal neutrons. Author

N63-10405 Stanford U. Inst. of Theoretical Physics, Calif.
EVALUATION OF THE VAN HOVE CORRELATION FUNCTIONS FOR CERTAIN PHYSICAL SYSTEMS
Roger B. De Bar [1962] 24 p 13 refs Prepared for journal publication
(Partially supported by AFOSR)
(ITP-74)

The space and time Fourier transforms of the Van Hove correlation function are evaluated for the cases of coherent scattering from simple crystals and, in a "quantum hydrodynamics" approximation, from liquid HeII. A compact approximate expression for the one-phonon part of the crystal correlation function transform is given, and the contribution of the two-phonon term is considered. A new method of obtaining quantum-mechanical corrections to the classical expression for the Van Hove self-correlation function is discussed, and the result is shown to be of greater potential accuracy than those previously given in the literature. As a test, the prescription is applied to the Langevin equation result for the classical correlation function, and the product is found to differ significantly from recent results, but to be in agreement with an older expression obtained by Vineyard. Author

N63-10407 Argonne National Lab., Ill.
PHYSICS DIVISION SUMMARY REPORT, JULY-AUGUST 1962 [Informal Progress Report]
Morton Hamermesh et al [1962] 97 p refs
(Contract W-31-109-eng-38)
(ANL-6603)

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N63-10424 California Inst. of Tech. W. M. Keck Lab. of Engineering Materials, Pasadena
THE INFLUENCE OF TEMPERATURE AND PREFERRED ORIENTATION ON HALL COEFFICIENT AND RESISTIVITY OF PURE TITANIUM
Louis C. Roesch Nov. 1962 118 p 30 refs
(Contract AF 49(638)-1034)

An experimental apparatus capable of measuring voltages in the microvolt region with an accuracy of $\pm 5.10^{-9}$ volts is used to determine the temperature variation of resistivity and Hall coefficient of three specimens of iodide titanium. These specimens are of comparable purity (room temperature to liquid helium temperature resistance ratio near 30) and possess a high degree of preferred orientation. The measurements are made at temperatures between 4.2 and 300°K. The Hall coefficient is found to depend strongly on temperature and crystalline texture. At room temperature it has a value of -1.8×10^{-11} m³/coulomb in two specimens, whereas in the third it equals $+ 1.2.10^{-11}$ m³/coulomb. It is proposed that crystallographic orientation is the most influential factor. Author

N63-10441 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio
DISTRIBUTION OF TEMPERATURE IN A HOLLOW INFINITE CYLINDER
B. I. Kogan and A. F. Khrustalev Oct. 8, 1962 7 p 2 refs Transl. from Tezisy Dokladov i Soobshcheniy Na Soveshchanii Po Templo i Massobmenu [Theses of reports and communications from the Conference on Heat and Mass Exchange] Minsk, June 5-9, 1961 p 1-8
(FTD-TT-62-1392/1+2)

A study is made of the temperature field of a hollow infinite cylinder in which heat sources are distributed with densities depending upon cylinder radius and given boundary conditions. The solution consists in determining functions which satisfy the Poisson equation in a cylindrical system of coordinates. J.R.C.

N63-10442 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio
A GYROSCOPE WITH A FLUID ROTOR
V. V. Kastrov and V. M. Rogovoy Oct. 10, 1962 4 p Transl. of Soviet Patent No. 134453 (649943/26), Jan. 5, 1960
(FTD-TT-62-761/1+2+4)

The design of a gyroscope with a fluid rotor is presented. In this gyroscope, the natural balancing of a rotating fluid which has no rigid connection with the housing of the gyroscope is used as the rotor. In order to accomplish momentless readings, a phosphorescent fluid is used in the gyroscope, which is illuminated through the windows of the chamber. A microscope with a photoelectric system is used to make the readings. J.R.C.

N63-10443 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio
INVESTIGATION OF THE PATH OF RAYS IN A SPECULAR OPTICAL SYSTEM
B. L. Poshekhonov Oct. 8, 1962 11 p Transl. from Izv. Vysshikn Uchebn. Zavedenii. Priborostr., v. 4, no. 4, 1961 p 78-84
(FTD-TT-62-1218/1+2)

A specular optical system is analyzed by the chart-analysis method to illustrate the value of this method in designing optical systems. The spatial path is determined for both separate rays and for luminous planes in a three-mirror system. The chart-analysis method of computation involves a visual graphic and an analytical method of solving spatial geometrical problems. R.C.M.

N63-10461 California U., Livermore. Lawrence Radiation Lab.
LASERS, A BIBLIOGRAPHY
Carl J. Wensrich Jan. 1962 16 p 129 refs
(Contract W-7450-eng-48)
(UCRL-6769) OTS: $0.50

This bibliography on Light Amplification by Stimulated Emission of Radiation is compiled from the journal literature with few exceptions. All the standard library sources were used. Author

N63-10465 Los Alamos Scientific Lab., N. Mex.

RISE THROUGH THE ATMOSPHERE OF A HOT BUBBLE

Francis H. Harlow and Billy D. Meixner Nov. 13, 1962 18 p
(Contract W-7405-eng-36)
(LAMS-2770) OTS: $0.50

The Particle-in-Cell method for multidimensional fluid-dynamics calculations has been used on the IBM Stretch Computer to study the motion of a hot gas bubble created by a nuclear explosion in the earth's atmosphere. In the example, a total energy of 8.24×10^{29} ergs was deposited at an altitude of 95 km. After 2.85 sec, the originally heated air was moving upward with a mass-averaged velocity of 3.5 km/sec and was still accelerating somewhat, probably to an asymptotic value of 4.0 km/sec. Along the cylindrical axis at 2.85 sec, the upward velocities varied from 0.0 km/sec at the bottom to 5.8 km/sec at the top; most of the central material was moving at velocities greater than 4.0 km/sec. This report also includes details concerning bubble shape, energy histories, and shock configurations. Author

N63-10484 Yale U., New Haven, Conn.

EXPERIMENTAL LIMITS FOR THE ELECTRON-PROTON CHARGE DIFFERENCE AND FOR THE CHARGE OF THE NEUTRON

Jens C. Zorn (Ph.D. Thesis), George E. Chamberlain, and Vernon W. Hughes [1961] 52 p 36 refs
(NASA Grant NsG-1-59)
OTS: $5.60 ph, $1.76 mf

Upper limits for the electric charges on the atoms of cesium and potassium and the molecules of hydrogen and deuterium have been measured by a molecular beam deflection method. The results are:

$$q(Cs) = (1.3 \pm 5.6) \times 10^{-17}\, q_e$$
$$q(K) = (-3.8 \pm 11.8) \times 10^{-17}\, q_e$$
$$|\, q(H_2)\,| < 2 \times 10^{-15}\, q_e$$
$$|\, q(D_2)\,| < 2.8 \times 10^{-15}\, q_e$$

(q_e is the absolute value of the electron charge). They are consistent with the usual view that atoms and molecules are electrically neutral. The results on H_2 and D_2 provide very direct upper limits of 1×10^{-15} q_e for the electron-proton charge difference and 2.4×10^{-15} q_e for the neutron charge. The cesium result can be interpreted as showing that the magnitude of the electron charge differs from that of the proton by less than 5 parts in 10^{19} and that the neutron charge is less than 5×10^{-19} q_e. The relevance of charge equality to cosmological theory and to the theory of elementary particles is discussed. Author

N63-10489 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio

POSITRONIUM LIFETIME IN CONDENSED HYDROGEN

D. C. Liu and W. K. Roberts Repr. from Phys. Chem. Solids, v. 23 p 1337-1340 10 refs Preliminary report presented at the Am. Phys. Soc. Meeting, Apr. 1962

The orthopositronium lifetime τ_2 in gaseous, liquid, and solid hydrogen has been measured; τ_2 is 31·2 ± 1·5 nsec for liquid at normal temperature of ebullition and is 16·3 ± 0·8 nsec for solid below the melting point. There is a sharp rise in τ_2 at melting, but the abundance of the orthopositronium component I_2 remains the same. For gaseous hydrogen at densities corresponding to the liquid and solid densities, τ_2 is density-dependent and shows no rapid change in the density range of the solid-to-liquid phase transition. These results lead to the conclusion that the orthopositronium lifetime or its pickoff rate is influenced by the physical state of the condensed hydrogen. Author

N63-10498 California U., Riverside

TABLES OF NON-RELATIVISTIC ELECTRON TRAJECTORIES FOR FIELD EMISSION CATHODES Technical Report No. 3

Allan M. Russel Oct. 1962 209 p 3 refs
(Contract Nonr-1842(02))

Tables are presented of nonrelativistic electron trajectories for field emission cathodes which include the following information: initial momentum; emitter radius; and potential of the midplane. This report also contains a description of the tables and a computer program for calculating the presented information. J.R.C.

N63-10501 Knolls Atomic Power Lab., Schenectady, N.Y.

KERNEL AND PAM—PROGRAMS FOR USE IN THE CALCULATION OF THE THERMAL SCATTERING MATRIX FOR CHEMICALLY BOUND SYSTEMS

F. D. Federighi and D. T. Goldman Sept. 17, 1962 30 p 7 refs
(Contract W-31-109-eng-52)
(KAPL-2225) OTS: $1.25

This report is divided into two major portions. The first is a description of the KERNEL program, its development and application for calculating inelastic scattering probabilities of thermal neutrons from chemically bound target nuclei in moderators. The second part describes how the detailed input data for KERNEL can be obtained with a second program, PAM, according to either the Nelkin model for water or a four-oscillator model for polyethylene. FORTRAN source programs are included for both KERNEL and PAM. Author

N63-10504 California U., Berkeley. Lawrence Radiation Lab.

ON THE MEASUREMENTS OF LIFETIMES, EXCITATION FUNCTIONS, DENSITIES, TOTAL CROSS SECTIONS, AND POLARIZATION RATIOS OF THE METASTABLE STATE OF THE NEON ATOM UNDER ELECTRONIC IMPACT

Tetsuo Hadeishi (Thesis) Sept. 25, 1962 104 p 33 refs
(Contract W-7405-eng-48)
(UCRL-10477) OTS: $2.25

The values of lifetimes, excitation functions, densities, total cross sections, and polarization ratios of the metastable state $(2\,^3P_{3/2}3\,^3S_{1/2})_2$ of neon at various pressures under electronic impact have been measured by use of an electron gun. A method of obtaining the total cross section from the measurement of lifetime, electron flux, excitation function, and width of the resonance line is derived and discussed. Author

N63-10518 Atomic Energy Commission. Div. of Technical Information, Washington, D.C.

REACTOR SAFETY: A LITERATURE SEARCH

Richard J. Smith, comp. Mar. 1962 104 p 1558 refs
(TID-3525 (Rev. 4)) OTS: $2.25

A total of 1555 references to unclassified reports and published literature is presented on reactor systems, materials, and operation designed to provide maximum safety for the reactor, reactor personnel, and environs. Information is included concerning incidents and conditions of operation considered hazardous. Author and report number indexes are provided. Author

N63-10519 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

PROBLEMS IN THE PHYSICS OF METALS AND METALLOGRAPHY (SELECTED ARTICLES)

L. I. Lysak, I. Ya. Dekhtyar, and V. S. Mikhailenkov Sept. 17, 1962 66 p 65 refs Transl. of three articles from Sb. Nauchn. Rabot Inst. Metallofiz., Akad. Nauk Ukr. SSR (Kiev), no. 12, 1961 p 21-36, 46-60, 124-134
(FTD-TT-625/1+2)

CONTENTS:

1. THE INFLUENCE OF HARDENING AND TEMPERING ON THE FINE CRYSTAL STRUCTURE OF MARTENSITE L. I. Lysak p 1-24 31 refs

2. STUDY OF THE ENERGY STATE OF ELECTRONS IN METALS UTILIZING THE PHENOMENON OF ANNIHILATION OF POSITRONS BY ELECTRONS I. Ya. Dekhtyar and V. S. Mikhailenkov p 25-47 15 refs
3. THE INFLUENCE OF ALLOYING ELEMENTS ON CHANGES IN MOSAIC STRUCTURE AND MARTENSITE CRYSTAL-LATTICE DISTORTIONS L. I. Lysak p 48-63 19 refs

N63-10542 Oak Ridge National Lab., Tenn.
STUDIES OF THE SCINTILLATION PROCESS IN CsI(Tl)
R. Gwin and R. B. Murray Nov. 30, 1962 134 p 48 refs
(Contract W-7405-eng-26)
(ORNL-3354) OTS: $2.50

An experimental investigation of the scintillation process in CsI (*Tl*) crystals has been made. The scintillation response of CsI(*Tl*) crystals, having various thallium contents, was measured for excitation of the crystals by monoenergetic gamma rays, protons, and alpha particles. The investigation was made to provide a test of some of the features of a theoretical model of the scintillation process in thallium-activated alkali iodides proposed by Murray and Meyer. The results of the investigation have shown that the scintillation efficiency of CsI(*Tl*) is a continuous function of dE/dx, as assumed in the scintillation model, within the accuracy of the experiments when the effect of delta rays are considered. This leads to the conclusion that the light output of CsI(*Tl*) crystals is, in general, a nonlinear function of the energy of the particle. The shape of the dL/dE versus dE/dx curve for CsI(*Tl*) crystals has been shown, in this work, to be nearly independent of the thallium content of the crystal. This is in distinct contrast to the predictions of the scintillation model. An examination of the emission spectra of CsI(*Tl*) crystals has shown that light is emitted in a band, centered at about 3300A, which is characteristic of the emission of the pure crystal, as well as the characteristic thallium luminescence. It has been suggested that thallium-activator luminescence results from the successive capture of an electron and a hole at a thallium center. The 3300A emission band of CsI overlaps the optical-excitation spectrum of CsI(*Tl*) for thallium-activator luminescence. Some thallium centers in CsI(*Tl*) are therefore excited by optical emission in the 3300A band. Author

N63-10556 Göttingen U. Physikalisches Inst. (W. Germany)
ABSORPTION AND TRANSMISSION OF ELECTROMAGNETIC WAVES. PHASE J: INVESTIGATION OF INTERDEPENDENCE OF ABSORBER DESIGN PARAMETERS (BROAD-BAND MAGNETIC LAYER ABSORBERS WITH SMALL THICKNESS) Technical (Annual) Report
H. W. Helberg Sept. 30, 1962 36 p 5 refs
(Contract AF 61(052)-154)
(RADC-TDR-62-528)

Two ferrite materials, Ferramic E and Ferramic E 1960, were used as magnetic layer absorbers. The measured reflection coefficients were below 10% in the frequency ranges $4.2 \cdot 10^7$ to $3.8 \cdot 10^8$ cps (1:9.1) and $2.4 \cdot 10^8$ to $7.6 \cdot 10^8$ (1:3.2), respectively. The thicknesses of layer were 0.88 cm and 0.5 cm, respectively. These measurements confirmed the reflection coefficients calculated from ϵ and μ. Various materials were tested with respect to their applicability as absorber material. Author

N63-10561 Radio Corp. of America. RCA Labs., Princeton, N.J.
INVESTIGATION OF CARRIER INJECTION ELECTROLUMINESCENCE Semi-annual Scientific Report No. 2, Covering the Period January 15, 1962-July 15, 1962
A. G. Fischer, W. Fonger, and A. S. Mason Aug. 15, 1962 135 p 4 refs
(Contract AF 19(604)-8018)
(AFCRL-62-588)

A summary is presented of work on AC electroluminescence of ZnS powder. Novel basic observations and new measurements on EL lines in powder particles are described. A new comprehensive model is derived and compared with previous models. The model is applied to all known facts of powder EL and yields many new insights. It is shown that AC-EL is caused by bipolar tunnel-injection. The realization of DC carrier injection electroluminescence is discussed. Conducting, photoluminescent ZnSe crystals grown from the melt under Zn pressure show high electron mobilities and display DC-EL. Pure ZnSe and ZnTe starting materials have been prepared by new methods, and advances in zone purification have been made. New difficulties have been encountered in Czochralski pulling of these materials, but at the same time new promising approaches have been found. Flux-grown GaP crystals show near-band-gap radiation, sublimed crusts bright red injection EL. No miscibility between GaP and BP could be observed, and BP was found to be extremely difficult to prepare in pure form. ZnSe has been recrystallized from supersaturated zinc flux. Luminescent single-crystalline ZnSe films have been grown on GaAs substrates and luminescent, conducting, near-single-crystalline CdS films have been prepared on conducting glass. A theoretical study of EL in injecting, wide-band-gap junctions has resulted in a promising new concept of DC tunnel injection through thin insulating films into luminescent material. Finally, basic studies of the optical properties of ZnSe films have been carried out. Author

N63-10563 Ohio State U. Research Foundation, Columbus
CORRELATION DIAGRAM FOR H_2: OSCILLATOR STRENGTHS Scientific Report No. 3
James M. Peek and Edwin N. Lassettre Sept. 1962 10 p 7 refs
(Contract AF 19(604)-4541)
(AFCRL-62-1042)

The one-electron Hamiltonian was assumed to be

$$\frac{-h^2}{8\pi^2 m}\nabla^2 u - e^2/r_{ba}\, u = \epsilon u$$

where the potential term has the following significance. Let the nucleus to the left of a plane which perpendicularly bisects a line connecting the two nuclei be designated by b and the one to the right by a. The function $-e^2/r_{ba}$ is defined as $-e^2/r_b$ when the electron is on the left of this plane and $-e^2/r_a$ when it is on the right side of this plane. That is, the electron is assumed to move in a coulombic field which is centered on the nucleus nearest the electron. In the solution, boundary conditions are applied on this plane which require that u either be symmetric or antisymmetric with respect to reflection through this plane (the correct symmetry for H_2). The choice of a one-electron potential function which contains no undetermined parameters has the advantage that a straightforward, although not necessarily simple, solution can be found without recourse to auxiliary requirements such as a variation principle. Author

N63-10567 Naval Ordnance Test Station, China Lake, Calif.
THE LOGARITHMIC TEMPERATURE DEPENDENCE OF THE PARTITION ENTROPY
D. S. Villars Sept. 1962 16 p 13 refs
(NOTS TP-3021; NAVWEPS-7970)

The partition part of the entropy (i.e., R ln Q) has a much simpler theoretical temperature behavior than entropy itself or enthalpy, yet completely defines the effect of temperature on the free energy. A study has been made of the dependence on logarithm of temperature, which in simplest cases reproduces the whole temperature effect, of the theoretical function for perfect gases. Quite good values are extrapolated for atoms and diatomic molecules. Discrepancies become greater as one proceeds to molecules having low-frequency vibrations. As would be anticipated, extrapolations in which two data points give an empirical number of effective virtual degrees of freedom are better than those obtainable by extrapolations from only one datum point. Author

N63-10569 Göttingen U. Physikalisches Inst. (W. Germany)
ABSORPTION AND TRANSMISSION OF ELECTROMAGNETIC WAVES. PHASE K: MULTILAYER ABSORBER Technical (Final) Report

H. W. Helberg and C. Wünsche Sept. 30, 1962 41 p 6 refs
(Contract AF 61(052)-154)
(RADC-TDR-62-529)

The equations for the reflection coefficient of a three-layer absorber contain 15 free parameters. Because of this large number of parameters, the equations were not discussed in general. Assuming values of ϵ and μ, which are independent of frequency, input impedance diagrams of three-layer absorbers were calculated. By variation of certain parameters, a favorable course of the reflection coefficient was aspired. With a thickness of layer $d = 0{,}21 \cdot \lambda_{max}$ the reflection coefficient $|r|$ remains below 13% all at smaller wavelengths. The bandwidth for $|r| \leq 10\%$ is 1:2.5 This absorber contains three layers with ϵ and μ increasing stepwise from free space to the last layer. For the experimental realization of such absorbers, homogeneous mixtures of paraffin and carbonyl iron powder and regular arrangements of damping cylinders in a nondissipative dielectric are used. Free-field measurements produced a bandwidth of 1:2.28 for $|r| \leq 10\%$ in the most favorable case. The necessary thickness of layer was $d \approx 0{,}25 \cdot \lambda_{max}$. At small wavelengths, the efficiency of the absorber is determined by the properties of the first layer only.
Author

N63-10570 Göttingen U. Physikalisches Inst. (W. Germany)
ABSORPTION AND TRANSMISSION OF ELECTROMAGNETIC WAVES. PHASE M, PART A: COMBINATION OF MAGNETIC LAYER- AND WEDGE TYPE ABSORBERS
R. Pottel and E. Schunk Sept. 30, 1962 37 p 5 refs
(Contract AF 61(052)-154)
(RADC-TDR-62-531, Vol. 1)

An absorption arrangement for electromagnetic waves is being designed incorporating a combination of magnetic layer absorbers and inhomogeneous absorbers. The amplitude reflection coefficient should be below 10% throughout the cm-waves range and also in part of the m-waves range. Matching conditions derived from transmission line theory are evaluated by quadripole measurements. Rib absorbers are used as inhomogeneous absorbers because they are produced with relative ease. The reflection coefficient of such rib absorbers is measured in a coaxial line as function of the frequency for a number of parameters like surface resistivity of the foil, length of the wedge-shaped transition, and total length of the sample. The electrical contact between the ribs—consisting of graphite paper—and the adjoining parts of the line was found to be of great significance. Measurements with combinations of ferrite and wedge absorbers have produced a number of useful results. More measurements have to be carried out with other thicknesses of the ferrite layer and with higher surface resistivities of the foil.
Author

N63-10571 Göttingen U. Physikalisches Inst. (W. Germany)
ABSORPTION AND TRANSMISSION OF ELECTROMAGNETIC WAVES. PHASE M, PART B: COMBINATION OF MAGNETIC LAYER- AND GRAPHITE FOIL ABSORBERS Technical (Annual) Report
H. W. Helberg and N. Roy Sept. 30, 1962 2 p 4 refs
(Contract AF 61(052)-154)
(RADC-TDR-62-531, Vol. II)

The electromagnetic properties of a ferrite layer placed in front of a metal plate are investigated. For this purpose, the reflection coefficient is measured as a function of the frequency with the thickness of the sample as parameter. The measurements are carried out in a coaxial line with Ferramic E 1960 as test substance. With a ferrite layer of 25,8 mm thickness and a surface resistivity of 880Ω $|R| \leq 10\%$ is achieved within the range of frequencies 12 mc to 160 mc. This corresponds to a frequency bandwidth of about 1 : 13. Without resistivity foil, the reflection coefficient remains above 10% in the entire range.
Author

N63-10572 Göttingen U. Physikalisches Inst. (W. Germany)
ABSORPTION AND TRANSMISSION OF ELECTROMAGNETIC WAVES. PHASE L: RESONANCE ABSORBERS WITH ABSORBING STRUCTURES IN OR BEHIND A METAL PLATE Technical (Final) Report
S. Luhmann Sept. 30, 1962 64 p 14 refs
(Contract AF 61(052)-154)
(RADC-TDR-62-530)

A number of resonance absorbers for electromagnetic waves are described, which serve for the reflectionless coating of a metal wall. The absorbers treated here are characterized by the fact that the absorbing structure is placed behind the metal wall to be protected. Coupling of the incident wave to the absorbing structure is made through small openings in the metal plate. Rectangular, triangular, and circular ring slots were used as coupling holes. With a wedge absorber behind the metal plate, the reflection coefficient r was below 0.1 within a frequency interval with a relative bandwidth of about 10%. Absorbing strip-line components were developed in order to achieve a thin absorbing structure and to compensate the frequency dependence of the impedance of the coupling holes. With these components, an operating range $r < 0.1$ with a relative bandwidth of about 6% was attained. The reflection coefficient was measured in the frequency range 8 to 14 kmcps. Its dependence on the number of coupling holes per unit area and on various parameters of the absorber elements was investigated.
Author

24 PHYSICS, PLASMA

Includes: fusion; and magnetohydrodynamics.

For related information see: 05 Astronomy and Astrophysics; 23 Physics, General; and 25 Physics, Solid-State.

N63-10082 Boeing Scientific Research Labs., Seattle, Wash.
NON-SIMILAR NUMERICAL METHODS OF SOLUTION FOR ELECTRODE BOUNDARY LAYERS IN A CROSSED FIELD ACCELERATOR
Gerhard L. Grohs Aug., 1962 52 p 20 refs
(D1-82-0192; Flight Sciences Lab. Rept.-63)

A numerical method of solution for the electrode boundary layer problem in a crossed-field plasma accelerator has been presented, which allows a direct study of nonsimilar properties of the boundary layer profiles. It is applicable not only to a wide variety of free-stream solutions with or without Hall-effect, but in essence to compressible boundary layers in general. Suggestions for a modification of the Karman-Pohlhausen integral technique have been discussed also.
Author

N63-10317 Princeton U. Plasma Physics Lab., N. J.
EXACT STATISTICAL MECHANICS OF A ONE-DIMENSIONAL SYSTEM WITH COULOMB FORCES. III. STATISTICS OF THE ELECTRIC FIELD
Andrew Lenard Oct. 1962 44 p 5 refs
(Contract AT(30-1)-1238)
(MATT-144)

The statistics of the electric field in a one-dimensional "sheet" plasma is studied. It is shown that the electric field as a function of the space coordinate is a Markov process, whose basic probabilities are related to the Fourier coefficients of certain functions that play an important role in the previously found development of the grand partition function. Some implications regarding the statistics of particle locations are explored. The one point probability distribution of the electric field is found to be asymptotically Gaussian in the plasma limit. The one-dimensional analog of the Holtsmark calculation leads to an incorrect conclusion because electrostatic shielding is not properly taken into account.
Author

N63-10319 Princeton U. Plasma Physics Lab., N. J.
FOUR LECTURES ON FUSION POWER
Rogert G. Mills Sept. 21, 1962 61 p 18 refs Presented at the Princeton U. Summer Inst. in Plasma Physics, June 25-Aug. 3, 1962
(Contract AT(30-1)-1238)
(MATT-145)

The characteristics of future power plants based on confined plasmas are discussed to show that reasonable assumptions can be made which lead to the prospect of immediate application of fusion plants. The machine considered would be a continuously operating DT reactor, utilizing a neutron blanket and associated steam cycle, with plasma confinement by a magnetic field such as the stellarator and the magnetic mirror. The mirror has injector efficiency problems and the stellarator stabilizing winding problems. Assuming the successful solution of these problems—an electric power output to magnetic power ratio of two, a dimensionless parameter of 12%, and a magnetic field of 120 kG—it is shown that for the magnetic mirror the economic minimum radius is 31.4 cm and the net output power is 170 MW. For the same assumptions, the economic minimum radius is 23.8 cm for the stellarator and the net output power is 270 MW. R.C.M.

N63-10331 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio
THE PROPAGATION OF ELECTROMAGNETIC WAVES IN PLASMA ACROSS AN EXTERNAL MAGNETIC FIELD
Yu. N. Dnestrovskiy and D. P. Kostomarov Sept. 13, 1962 16 p 3 refs Transl. from Zh. Vychislitel'noi Mat. i Matematicheskoi Fiz., v. 2, no. 1 p 97–106
(FTD-TT-62-1187/1+2+4)

A study is made of the propagation of electromagnetic waves in a plasma across an external magnetic field. This is done to determine the effect of complex roots in the dispersion equation on the energy transfer between the plasma and the electromagnetic field. Solutions to the problem are presented for two cases: the excitation of waves by extraneous currents harmonically depending on time, and a given initial perturbation when the extraneous currents are equal to zero. These indicate that, in spite of the presence of complex roots in the dispersion equation, there is no energy transfer between the plasma and electromagnetic waves at the stage of a steady-state regime. R.C.M.

N63-10347 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio
ISOTHERMAL ACCELERATION OF A ONE-DIMENSIONAL PLASMA FLOW IN EXTERNAL TRANSVERSE HOMOGENEOUS MAGNETIC AND ELECTRICAL FIELDS
V. M. Sarychev Sept. 20, 1962 8 p 3 refs Transl. from Zhur. Priklad. Mekan. i Tekhn. Fiz. (USSR), no. 1, 1962 p 12–14
(FTD-TT-62-1186/1+2+4)

The acceleration of a one-dimensional plasma flow in external transverse electrical and magnetic fields was considered. Assuming the applicability of one-dimensional equations of continuous media, isothermal acceleration of plasma is considered in external transverse homogeneous magnetic and electrical fields in two particular cases: a) with constant current density along the channel and b) in a channel with a constant angle of expansion. Isothermal acceleration of plasma in a thermal jet is also considered. An investigation is made for two forms of the dependence of the conductivity of plasma on its density. Author

N63-10361 Princeton U. Plasma Physics Lab., N. J.
ON THE USE OF MAGNETICALLY COMPRESSED PLASMAS IN A STELLARATOR
D. L. Dimock, J. M. Dawson, and M. A. Rothman July 1962 43 p 1 ref
(Contract AT(30-1)-1238)
(MATT-133)

High density plasmas produced in linear, single-turn coil, theta pinch geometries are analyzed for possible application to stellarator devices. Two approaches are considered: making the single turn coil into a torus and injecting from a straight theta pinch. Calculations of the shift in equilibrium are made for the torus approach, and the currents resulting from compression are analyzed. From this data, it appears doubtful that the torus device would be stable. Calculations on the injection approach and the effects of expansion in this device are made and indicate that it would be possible to use these compression sections to fill a stellarator with a hot plasma. R.C.M.

N63-10449 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio
SIMPLEST PROBLEMS INVOLVING A GAS-IONIZING SHOCK WAVE IN AN ELECTROMAGNETIC FIELD
A. G. Kulikovskiy and G. A. Lyubimov Oct. 9, 1962 8 p 3 refs Transl. from Doklady Akad. Nauk SSSR (Moscow), v. 129, no. 3, 1959 p 525–528
(FTD-TT-62-1219/1+2)

A study is made of simple problems involving a gas-ionizing shock wave in an electromagnetic field. It is shown that such shock waves can be considered as the limit of continuous motion of a viscous heat conducting gas with the electrical conductivity as a function of temperature. The solution of problems containing gas-ionizing shock wave differ from the solution of these problems in gas dynamics and magneto-gas-dynamics. This difference consists not only in the presence of the magnetoelectric wave, but also in the change in the gas dynamics of the motion. Solutions are given for the problems of a flat plunger and for flow around a wedge. J.R.C.

N63-10500 California U., Livermore. Lawrence Radiation Lab.
PLASMA DYNAMICS
S. A. Zwick Apr. 1962 140 p 10 refs
(Contract W-7405-eng-48)
(UCRL-6879) OTS: $2.50

This paper was prepared from lecture notes and problems on plasma dynamics. The material consists of a development of pertinent electromagnetic theory, a discussion of individual particle motions from a classical viewpoint, a derivation of the Boltzmann equation, and a development of the hydromagnetic approach to plasma problems. The inconsistencies of the classical model are discussed. R.C.M.

N63-10517 Plasmadyne Corp., Santa Ana, Calif.
EXPERIMENTAL AND THEORETICAL STUDIES OF MHD SHEAR HEATING Final Technical Documentary Report
Sept. 1962 35 p 5 refs
(Contract Nonr-3518 (00))

Magnetohydrodynamic (MHD) shear heating, which occurs at the interface of two counter-rotating layers of plasma, has long been considered an attractive mechanism for rapidly heating a confined plasma. Consequently, an experimental program is being conducted to examine the feasibility of such a scheme. The two interacting plasmas are initially set into rotational motion via the application of $\underset{\sim}{J} \times \underset{\sim}{B}$ Lorentz forces. Insofar as their longitudinal collisional velocities are concerned, these are produced in the coaxial plasma guns. This technique (rotational shear) for heating a plasma has three important features: 1) Although the Joule heating decreases as the plasma temperature rises because of a decrease in resistivity, the viscosity increases with temperature, 2) energy transfer to the plasmas becomes more efficient as rotation increases, and 3) the magnetic field providing the rotational effect also serves to confine the plasma via a mirror machine configuration. Author

N63-10531 Republic Aviation Corp. Plasma Propulsion Lab., Farmingdale, N.Y.

CHARACTERISTICS OF THE PINCH DISCHARGE IN A PULSED PLASMA ACCELERATOR

Leonard Aronowitz and Donald P. Duclos N.Y., Am. Rocket Soc. [1962] 24 p 9 refs Presented at the ARS Electric Propulsion Conf., Berkeley, Calif., Mar. 14-16, 1962

(Contract AF 49(638)-552)

(ARS paper-2376-62) ARS: $0.50 members, $1.00 nonmembers

Electrical characteristics of a pulsed plasma accelerator were studied. The accelerator was operated at a maximum potential of 3 kv, a maximum energy of 540 joules, a maximum current of 2.6 × 10^5 amps, and a ringing frequency of about 165 kc. Plasma velocities up to about 9 cm/microsecond, and electron densities of the order of 10^{15}/cm³ were measured. Reproducibility of data was good for initial capacitor voltages above 2,000. Below this voltage, reproducibility and symmetry of discharge deteriorated. Plasma velocity was found to vary linearly with initial capacitor energy. Author

25 PHYSICS, SOLID-STATE

Includes: semiconductor theory; and masers.

For related information see: 09 Electronics; 23 Physics, General; and 24 Physics, Plasma.

N63-10101 Boeing Scientific Research Labs., Seattle, Wash.

SOME NEW TECHNIQUES FOR SCATTERED LIGHT PHOTOELASTICITY

Y. F. Cheng Sept. 1962 19 p 6 refs

(D1-82-0202)

In Boeing Document D1-82-0165 the author proposed a new method for the precision measurement of fractional birefringence in photoelasticity. The present paper is a continuation of the previous one. It deals with some new techniques in determining the directions of the secondary principal stresses (they are referred to as the secondary principal axes throughout the paper) and their difference in scattered light photoelasticity. Experiments were made for cases where the secondary principal axes remain constant, and good agreements were found. Author

N63-10174 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio

EFFECT OF OXIDIZER PARTICLE SIZE ON ADDITIVE AGGLOMERATION

Louis A. Povinelli Washington, NASA, Nov. 62 31 p 12 refs

(NASA TN D-1438) OTS: $1.00

Oxidizer particle size was found to influence aluminum agglomeration during combustion, at atmospheric pressure, of propellant samples composed of ammonium perchlorate, polybutadiene acrylic acid, and aluminum. The results obtained were in agreement with a quantitative model presented for the additive growth process. Emission spectra were obtained for aluminized and nonaluminized propellants and interpreted in terms of the agglomeration process. Film supplement available on request. Author

N63-10250 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

AN OPERATIONAL 960-Mc MASER SYSTEM FOR DEEP-SPACE TRACKING MISSIONS

T. Sato and C. T. Stelzreid Repr. from IRE Trans. on Space Electronics and Telemetry, June 1962 p 164–170 11 refs

(NASA Contracts NAS7-100 and NASw-6)

(JPL-TR-32-306)

An operational 960-mc low-noise receiving system for use in deep-space tracking missions is described. A ruby-cavity maser, low-noise antenna, low-loss transmission line connecting the antenna to the maser and associated instrumentation all combine to yield reliable and low-noise performance. Results of tests on this system in preparation for the Ranger RA-3 lunar probe are presented. The system was successfully used during operations with RA-3. A minimum system temperature of 47°K has been achieved. Author

N63-10310 Watertown Arsenal. Materials Research Lab., Mass.

POLAR MODEL OF ORDERING ENERGY IN ALLOYS

Ralph J. Harrison and Arthur Paskin Sept. 1962 12 p 13 refs

(MRL-123)

The introduction of the more recent concepts of electronic screening in metals applied to the AB alloys leads to a polar model resembling that of Mott. The A and B atoms have opposite charges mainly related to their differences in valence. The ordering energy estimated from the theoretical screening parameters for β brass is in reasonable agreement with experiment, lending support to the physical validity of this model. The basic assumptions and consequences of the model with respect to the ordering energy are reviewed. In addition, an extension of this model to the computation of the electronic contribution to the elastic spectrum of the alloy is discussed. Author

N63-10315 South Dakota School of Mines and Tech., Rapid City

THE EFFECT OF A MAGNETIC FIELD ON THERMAL AND ELECTRICAL PROPERTIES OF MAGNESIUM STANNIDE AND INDIUM ANTIMONIDE Technical Report No. 7

Ronald J. Kostelecky (M.S. Thesis) Nov. 1, 1962 68 p 19 refs

(Contract Nonr-2964(01))

The measurements performed allowed the determination of (1) the value and the relative change in a magnetic field of the thermal conductivity of InSb and Mg_2Sn, (2) the relative change in a magnetic field of the Seebeck coefficient of InSb and Mg_2Sn, and (3) the relative change in a magnetic field of the electrical resistivity of InSb. All the measurements were conducted in a pressure of about $5(10)^{-5}$ mm of Hg. The thermal conductivity of both Mg_2Sn and InSb decreased with an increase in temperature. Values of 147.5 mw/cm° C at 308° K and 91.2 mw/cm° C at 575° K were determined for InSb. The extreme values determined for Mg_2Sn were 67.1 mw/cm° C at 374° K and 60.4 mw/cm° C at 571° K. The maximum relative change (change in value divided by the zero-field value) of the thermal conductivity observed was −8.8% for InSb at 575° K and −1.7% for Mg_2Sn at 376° K both in a field of 8000 gauss. A maximum change in the Seebeck coefficient of 8.6% was noted for InSb at 473° K in a field of 8000 gauss; for Mg_2Sn, a maximum of 2.9% was noted at 376° K. The maximum change in electrical resistivity observed for InSb was 170% at 406° K and a field of 8000 gauss. Author

N63-10348 Air Force Systems Command. Foreign Technology Div., Wright-Patterson, AFB, Ohio

ACTIVATION MECHANISM OF CdS SINGLE CRYSTALS IN THE PRESENCE OF LOCAL X-IRRADIATION

A. Ye. Kiv Sept. 20, 1962 11 p 9 refs Transl. from Nekotoryye Vopr. Prikl. Fiziki (Tashkent, Uzbek SSR), 1961 p 86-93

(FTD-TT-62-885/1+2+4)

A study is made of CdS single crystals irradiated locally by X-rays with a quantum energy less than 0.1 mc^2. Activation of the crystals takes place as a result of diffusion of defects into the nonirradiated portions of the crystal and the filling of the crystal volume with recombination centers, which change the lifetime of the carriers. The activation is also due to the migration of excited electrons throughout the crystal, which makes possible the redistribution of electrons among the recombination centers. The lifetime of an activated crystal is determined by the duration of the annealing process in the irradiated crystal. Thermal excitation of the crystal lattice leads to complete removal of activation and to the annealing of the corresponding defects. J.R.C.

N63-10366 Columbia U., New York, N.Y.
THE TEMPERATURE VARIATION OF THE ORDER DEPENDENT CONFIGURATIONAL ENERGY AND THE LATENT HEAT OF THE ORDER-DISORDER TRANSFORMATION IN Cu_3Au Final Technical Report, Part V, 22 Jan. 1958 to 21 Jan. 1961
Leon J. Schkolnick (Ph. D. Thesis and S. L. Quimby Oct. 10, 1962 41 p 17 refs
(Contract DA-30-069-ORD-2195)
(AROD-1931-5)

A method is described for measuring the heat transfer associated with a specified increase or decrease in the temperature of a mass of metal weighing as little as 10 grams. Availability of a high-speed digital computer is a requisite. The method is employed to ascertain the temperature variation of the internal energy of a specimen of Cu_3Au at equilibrium order between 300° C and 400° C. The vibrational energy is computed in accordance with the Kopp-Neumann law, and the difference yields the temperature variation of the interatomic configurational energy. A detailed study of the behavior of the material near the critical temperature for disordering permits an evaluation of the latent heat of the order-disorder transformation, which is found to be 2.86 ± 0.1 calories per gram. Author

N63-10367 Radio Corp. of America. RCA Labs., Princeton, N.J.
RESEARCH ON METALLIC CONTACTS TO SEMICONDUCTORS Final Report Covering the Period June 23, 1960 to June 22, 1962
A. M. Goodman and W. W. Mehl David Sarnoff Research Center, July 22, 1962 94 p 39 refs
(Contract DA-034-ORD-3283RD)
(AROD-2838-1)

Rectifying contacts have been prepared by plating metal onto crystallographically oriented, conducting, single crystal, cadium sulfide blocks. The net work function of the metal with respect to the semiconductor at the contact, $\Delta\phi$, was determined by analysis of differential capacitance, current-voltage and photoelectric measurements. All measurements were made at room temperature. Neither the current-voltage measurements nor the photoelectric measurements may be easily interpreted in terms of the simple Bethe diode theory for a single value of $\Delta\phi$. It is concluded that there is good evidence for the existence of patches of different $\Delta\phi$ at a gold contact to cadmium sulfide; the effective values of $\Delta\phi$ determined by the different measurements range from ~0.8 to 1.2 volts. The range of $\Delta\phi$ values determined for copper plated contacts was from ~0.6 to 0.72 volts. Author

N63-10406 Armour Research Foundation, Chicago, Ill.
EXCESS NOISE IN SEMICONDUCTORS (Annual Summary Report No. 7), Covering the Period of Nov. 15, 1961 to Nov. 14, 1962
James J. Brophy Oct. 31, 1962 71 p 7 refs
(Contract NOnr 1800(00))

Critical point polarization fluctuations in ferroelectric triglycene sulfate crystals have been measured at the Curie temperature by observing noise voltages appearing between electrodes applied to the crystal. The polarization noise is a simple relaxation spectrum with a time constant of 5.3×10^{-3} seconds. In barium titanate crystals a thermal Barkhausen noise with a 1/f power spectrum is observed when the crystal temperature is passed slowly through the Curie point, but critical fluctuations are not present, in agreement with the first order character of the transition. Experimentally it is found that the noise voltage appearing across a metallic conductor heated to high temperatures by d-c current flow is given by the Nyquist theorem, even though the conductor is not in thermodynamic equilibrium. At frequencies below that corresponding to the thermal time constant of the conductor, an additional noise voltage caused by thermodynamic temperature fluctuations is detected. Since low-frequency electrical noise in semiconductors is attributed to charge carrier fluctuations, corresponding fluctuations in optical absorption at wavelengths beyond the fundamental absorption edge caused by free carrier scattering are expected. A simple experiment employing an infrared interferometer is shown to be capable of detecting such fluctuations in optical absorption. Author

N63-10431 General Electric Co. Advanced Semiconductor Lab., Syracuse, N. Y.
SEMICONDUCTOR DEVICE CONCEPTS Scientific Report No. 1B
N. Holonyak, Jr., et al Aug. 31, 1962 17 p 7 refs
(Contract AF 19(628)-329)
(AFCRL-62-774(B))

Double injection diodes are described which, depending upon the kind of deep-level doping impurities employed, exhibit instabilities and coherent and/or noisy oscillations in normally positive resistance regions of the V-I characteristics. Similar oscillations in n-type bars of Si compensated with certain deep-level impurities are also described. The influence of deep levels on these phenomena is discussed. Some preliminary results on experiments with $GaAs_xP_{1-x}$ light emitting junctions are presented. Author

N63-10432 General Electric Co. Research Lab., Schenectady, N.Y.
SEMICONDUCTOR DEVICE CONCEPTS Scientific Report No. 1A
M. Aven, H. H. Woodbury, J. H. Racette, and R. N. Hall Aug. 31, 1962 18 p 10 refs
(Contract AF 19(628)-329)
(AFCRL-62-774(A))

Experiments are described which show that impurities are removed very effectively from crystals of II-VI compounds by heating the crystals in contact with liquid Zn or Cd. Distribution coefficients for Ag and Cu in several of these systems are reported. Light emitting p-n junctions have been prepared from $GaAs_xP_{1-x}$ mixed crystals. Edge luminescence in the visible spectrum has been observed. Portions of the ternary phase diagrams of the systems (Ga-As-Sn) and (Ga-As-Au) have been measured. In the latter system, a deep eutectic minimum has been located in the quasi-binary GaAs-Au section analogous to the behavior of the Ge-Au and Ge-Si systems. Author

N63-10488 Cornell U., Ithaca, N. Y.
EFFECT OF CRYSTALLINE IMPERFECTIONS UPON THE ELECTRICAL PROPERTIES OF SEMICONDUCTING INTERMETALLIC COMPOUNDS Final Report
C. W. Spencer Oct. 15, 1962 5 p
(Contract AF 49(638)-480)

Abstracts are given of papers on the electrical properties of the following systems: bismuth-tellurium; bismuth-selenium; and antimony-tellurium. The properties include the conductivity and the Hall effect at 600°C, and the resistivity at hydrostatic pressures up to 30,000 atm and temperatures above 100°C. R.C.M.

N63-10507 HP Associates, Palo Alto, Calif.
INVESTIGATION OF HOT ELECTRON EMITTER Scientific Report No. 1, June 1-Aug. 31, 1962
M. M. Atalla, R. W. Soshea, R. C. Lucas, C. H. Fox, and V. M. Dowler [1962] 43 p 5 refs
(Contract AF 19(628)-1637)
(AFCRL-62-772)

Experimental work has been carried out on silicon-gold barriers. This work included: (1) photoresponse measurements, (2) capacitance-voltage measurements, and (3) current-voltage characteristics measurements up to current densities as high as 3×10^4 amp/cm². The results are discussed in detail and compared to results of theoretical treatments. Author

26 PROPELLANTS AND COMBUSTION

Includes: fuels; igniters; and oxidizers.

For related information see: 07 Chemistry; and 27 Propulsion.

N63-10087 Feltman Research Labs., Picatinny Arsenal, Dover, N. J.

SPECTROGRAPHIC INVESTIGATION OF TEMPERATURES IN A PLASMA JET ARC TUNNEL

Seymour Lader Apr. 1962 13 p 11 refs
(Picatinny Arsenal Tech. Memo.-1001)

Spectrographic equipment has been assembled and is being used to study the plasma jet air stream. The ionization temperature in a free stream plasma jet, three inches from the nozzle, was measured with this equipment. Assuming a Boltzmann distribution and using the ratio of the intensity of two copper lines, a temperature of 6200°K was calculated. Author

N63-10140 Naval Ordnance Lab., White Oak, Md.

METHOD OF CALCULATING PRE-BURNED PROPELLANT GUN PERFORMANCE WITH SPECIAL APPLICATION TO TWO-STAGE GUNS

A. E. Seigel Jan. 1962 33 p 11 refs
(NOLTR-61-29)

The method of calculating the behavior of a projectile propelled by a preburned propellant in a chambered gun is reviewed. The influence of gas in front of the projectile in the barrel is discussed as is the procedure to take account of gas frictional and heat-transfer effects. The method of calculation by hand of the performance of two-stage guns is then outlined. Some results obtained from an electronic computing machine are compared to experimental results. Author

N63-10149 Atlantic Research Corp., Alexandria, Va.

A PROGRAM TO ADVANCE THE TECHNOLOGY OF FIRE EXTINGUISHMENT [Interim Report, Apr. 1961–Mar. 1962]

M. Markels, Jr., R. Friedman, O. Fry, A. Macek, E. DuZubay, and R. Eichbauer Wright-Patterson AFB, Ohio, Directorate of Aeromechanics, Sept. 1962 73 p 27 refs
(Contract AF 33(616)-8110)
(ASD-TDR-62-526)

Extinguishing agents for fires of liquid hydrogen in dewars and controlled spills, and detonation suppressants for mixtures of hydrogen and oxygen gases were evaluated. Both spill and dewar fires were most effectively extinguished by first applying a mechanical foam followed by potassium bicarbonate powder. Foam by itself decreased the intensity (burning rate) but extinguished neither type of fire. Water fog, steam, sodium bicarbonate, ABC powder, bromotrifluoromethane, and nitrogen were found ineffective as extinguishing agents. Ten additives were evaluated as suppressants. Carbon tetrachloride acted as a sensitizer for the detonation. Methane or methyl chloride inhibited the detonation, but iron pentacarbonyl was the best suppressant evaluated. Author

N63-10197 National Research Corp., Cambridge, Mass.

THERMODYNAMIC PROPERTIES OF BI-METALLIC POWDERS Quarterly Letter Report, July 1, 1962–Sept. 30, 1962

Ludwig G. Fasolino Nov. 9, 1962 18 p 6 refs
(Contract Nonr-3608(00))

The heat of combustion of lithium in an oxygen Parr bomb has been determined. The initial difficulties encountered when the combustion occurred in the presence of carbon and/or glass have been eliminated. The release of energy closely corresponds to the heat of formation of lithium oxide, Li_2O. The heats of solution of aluminum, lithium and aluminum-lithium alloy have been determined in 2 N HCl. From these data, the heat of formation of AlLi has been calculated. Author

N63-10326 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio

STUDIES OF THE LIQUID-VAPOR INTERFACE CONFIGURATION IN WEIGHTLESSNESS

Donald A. Petrash and Edward W. Otto N. Y., Am. Rocket Soc. [1962] 20 p Presented at the ARS Space Power Systems Conf., Santa Monica, Calif., Sept. 25–28, 1962
(ARS Paper-2514-62) ARS: $0.50 members, $1.00 nonmembers

Analytical and experimental results are presented for the behavior of rocket-engine propellants stored in space-vehicle tanks while exposed to weightlessness. The results of this fundamental investigation indicate that the prime factors determining the interface configuration in a tank are the minimization of the free surface energies of the system and the preservation of the liquid contact angle at the tank wall. It is therefore possible to predict the liquid configuration by knowing the tank geometry and the liquid contact angle. The application of these basic principles to the design of actual tank geometries was studied. The results indicate that internal tank baffling is an effective means of positioning the liquid in a suitable location for venting and engine restart. Author

N63-10354 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

REGULARITIES OBSERVED IN MIXTURES OF LIQUID FUEL DURING IGNITION

V. I. Blinov Sept. 11, 1962 8 p 4 refs Transl. from Inzhenerno-Fiz. Zhur. (Minsk), v. 4, no. 2, 1961 p 95-98
(FTD-TT-62-1037/1+2+4)

Equations are derived for determining the ignition limit for a mixture of combustible fluids. From the relationship of the low concentration limit of the ignition of a mixture of vapor and air, and the flash point, a single constant is determined. This constant replaces the six constants necessary for determining the ignition limit by the Le Châtelier principle. R.C.M.

N63-10381 Douglas Aircraft Co., Inc. Missile and Space Systems Div., Santa Monica, Calif.

DIELECTROPHORETIC PROPELLANT ORIENTATION IN ZERO GRAVITY

J. B. Blackmon *In* Air Force Systems Command. Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif. Transactions of the 7th Symp. on Ballistic Missile and Space Technol., U. S. Air Force Academy, Colo., Aug. 13–16, 1962 Vol. I p 295–324 5 refs (See N63-10370 01-01)

A plausible method of orienting liquid propellants in zero gravity is presented which utilizes the dielectrophoretic force induced on electrically neutral bodies in a nonuniform electric field. One of the most significant problems of propellant orientation in zero gravity is that, prior to an engine restart in space, sufficient propellant must be properly oriented for a constant flow to the engine during the restart transient. A dielectrophoretic orientation system shows promise of solving this problem. Moreover, the system has low weight and energy requirements when compared to the other methods of zero gravity propellant orientation. The possible applications of an orientation system using electric fields are discussed. Author

N63-10425 Feltman Research Labs., Picatinny Arsenal, Dover, N. J.

THE KINETICS OF THE HIGH TEMPERATURE REACTION BETWEEN MAGNESIUM POWDER AND OXYGEN

Elis S. Freeman and Clement Campbell Oct. 1962 27 p 9 refs
(Picatinny Arsenal Tech. Rept. 3013)

The kinetics and mechanism of the reaction between magnesium powder and oxygen between 550° to 590°C were investigated. The rates of reaction were studied as a function of surface area, particle size, partial pressure of oxygen, and temperature. A procedure for evaluating the kinetics of reaction where the specific rate and mechanism may change during the reaction is presented. The results were interpreted in terms of three rate processes: (1) the adsorption of oxygen on the surface of the metal, (2) the dissociation of adsorbed oxygen, and (3) the reaction between adsorbed atomic oxygen and a surface magnesium atom. A theoretical rate equation was derived based on this mechanism. The theoretical rate expression correctly predicts many of the experimentally determined rate parameters. Author

N63-10506 Thiokol Chemical Corp., Elkton, Md.
A RESEARCH STUDY TO ADVANCE THE STATE-OF-THE-ART OF SOLID PROPELLANT GRAIN DESIGN Quarterly Progress Report No. 9, July 1 to Oct. 1, 1962
Mary Pase, W. G. Andrews, David H. Frederick, Frederick E. Moore, Donald Saylak, Donald D. Thomas, and Robert H. Thompson Dec. 1, 1962 49 p 16 refs
(Contract AF 33(616)-6530)
(E173-62)

This program is a research study to advance the state-of-the-art of solid propellant grain design and consists primarily of theoretical and applied analyses of solid propellant grain designs, considering in particular heat transfer effects, propellant slump, and the effect of strain on burning rate. An analytical study is being undertaken to develop a two-dimensional heat transfer analysis for solid propellant motors subjected to a nonlinear external thermal environment. The application of this analysis to the Advanced Grain Design Computer Program, previously developed under this contract, is also being investigated to determine thermal effects upon ballistic characteristics. Author

27 PROPULSION

Includes: airbreathing, electric, liquid, nuclear, and solid propulsion.

For related information see: 04 Aircraft; 06 Auxiliary Systems; 26 Propellants and Combustion; and 30 Space Vehicles.

N63-10044 MAN-Turbomotoren G.m.b.H., Munich (W. Germany)
BERECHNUNG DER LEISTUNGSCHARAKTERISTIK VON STRAHLTRIEBWERKEN MIT HILFE DIGITALER RECHENAUTOMATEN [CALCULATION OF THE PERFORMANCE CHARACTERISTIC OF JET ENGINES WITH THE AID OF DIGITAL COMPUTERS]
G. Preininger [1962] 14 p In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9–12, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 49) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

A jet engine depends on a number of individaul components, assembled; and their proper fit, suitability for each other, and coordinated function are important in determining performance characteristics of the engine. These are the problems encountered in the design and development of such an engine. On the basis of appropriate control of quality, a well-defined coordination of established operating condition points, that the individual components find in relation to one another, permit the representation of the operating curves of the engine to the components technique field. The computational findings of this coordination, with consideration for the performance properties of the individual components, appears as a complex function that can only be read, practically, in a point-by-point numerical and iterative manner. The use of digital computers with great storage capacity is in question. The properties of the individual components must be stored in the computer in appropriate form, and control properties must be introduced by proper programing control. This paper attempts the fundamental buildup of such a program—one which will produce the performance characteristics of a turbojet engine. This accomplishment would be limited to the single-wave, single-cycle engine, with or without afterburner, or with a free-running after compressor, or work turbine. The fundamental thermodynamic and gasdynamic coordinations of a gas turbine working process are also reviewed in this paper. A.S.

N63-10045 Deutsche Versuchsanstalt für Luft- und Raumfahrt. Inst. für Luftstrahlantriebe, Porz (W. Germany)
BEITRAG ZUM AUFGEHEIZTEN ZWEIKREISTRIEBWERK (Vorläufige Fassung) [CONTRIBUTION TO THE HEATED TWO-CIRCUIT ENGINE (Preliminary Version)]
A. Meffert Sept. 1962 44 p 15 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9–12, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 50) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

Research indicated that heated two-circuit engines can be driven without heating up. This factor presents an advantage over one-circuit and combination engines by providing a better thrust characteristic. Of particular importance is the improvement of the two-circuit engine over the one-circuit engine at low speeds and moderate specific thrust; since even with high-speed airplanes the greater portion of the entire flight time must be flown at low speeds. The comparison cited permitted small improvement for flight speeds up to $M \approx 2$, somewhat of a similar order of magnitude as in a two-circuit engine without afterburning. At higher speeds no improvement can be expected. Considering the entire flight program, only small advantages can be expected, in spite of the adaptability of the two-circuit engine at low speeds. Graphic descriptions of this study are presented. Trans. by I.v.L.

N63-10048 Bölkow Entwicklungen K.G., Munich (W. Germany)
CHEMISCHE RAUMFAHRT-TRIEBWERKE (Vortragsmanuskript) [CHEMICAL SPACE TRAVEL ENGINES (Preliminary Manuscript)]
K. Stöckel [1962] 6 p In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9–12, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 53) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

The first portion of this paper is devoted to a discussion of the chemical rocket for space-travel. The various combinations of chemicals, the requirements for the various phases of space flight, the thrusts developed, and associated problems are discussed. The second portion of the paper deals with engine research accomplishments of the American space flight projects. A brief description of the propulsion system is given for Saturn C-1, Apollo A, Saturn C-5, and Project Nova. The third and final portion of the paper is devoted to the possibilities of increased efficiency and performance of chemical rockets and the corresponding rocket conceptions. A.S.

N63-10049 Deutsche Versuchsanstalt für Luft- und Raumfahrt. Inst. für Raumfahrtforschung, Porz (W. Germany)
DIE ENTWICKLUNG DER MAGNETOHYDRODYNAMISCHEN ENERGIEERZEUGER IN DEN USA [THE DEVELOPMENT OF THE MAGNETOHYDRODYNAMIC ENERGY GENERATOR IN USA]

Eugen Knoernschild [1962] 40 p 18 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9–12, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 54) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

For the past ten years, strong efforts have been in progress in the U.S.A. to develop methods that would permit the direct conversion of heat energy to electrical energy. One of these methods rests on the principle of crossed or interposed magnetic and electrical fields. In this process, the working medium becomes so intensely heated that it ionizes and becomes electrically conductive. The medium is then brought to a high velocity and sent through a magnetic field set transversely to the direction of flow. The motion of the conductor stream through the magnetic field generates an electrical field which is capable of driving current through a load resistance. A.S.

N63-10050 Deutsche Versuchsanstalt für Luft- und Raumfahrt. Inst. für Raumfahrtforschung, Porz (W. Germany)
UNTERSUCHUNGEN AN EINER ELEKTRODENLOSEN MHD-TRIEBWERKSANLAGE [STUDIES ON AN ELECTRODELESS MHD-ENGINE DESIGN]
Günter Pauer [1962] 22 p 8 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9–12, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 55). Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

The role of the electrodeless magnetohydrodynamic (MHD) jet engine is discussed, and a brief summary of some of the resulting problems are presented. Six characteristic parts of the engine were investigated. Results showed that a satisfactory general performance could be achieved only when each part was capable of high performance. Furthermore, a few of the many measurement methods such as for velocity and impulse, i.e., thrust measurements, are described and experimental results are noted. A study of the ignition curves of various gases should lead to the determination of jet engine performance during periodical operation. Trans. by I.v.L.

N63-10124 General Dynamics Corp. General Atomic Div., San Diego, Calif.
MASS OF HIGH VELOCITY GASES FROM TOROIDAL IMPLOSION CHARGES Nuclear Pulse Propulsion Concept
B. B. Dunne Oct. 31, 1962 10 p
(Contract AF 29(601)-2207)
(GAMD-3629)

This report summarizes the results of a number of experiments which were designed to measure pressure-velocity structure and to obtain a more quantitative measurement of the mass of gas in the high-speed components (>2.7 cm/μsec) of gas jets produced by toroidal implosion of cylindrical liners. Author

N63-10248 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
POTENTIALITIES OF ELECTRON BOMBARDMENT ION ENGINES FOR ELECTRIC PROPULSION
Daniel J. Kerrisk Repr. from IRE Trans. on Space Electronics and Telemetry, June 1962 p 188–193 11 refs
(NASA Contracts NAS7-100 and NASw-6)
(JPL-TR-32-301)

This paper discusses the expected performance of electron bombardment ion sources when used for electrostatic propulsion. Two particular sources, the duoplasmatron and the Penning ion source, are examined and suggestions are made on how their performance for application with electric thrust devices could be improved. It is concluded that electron bombardment sources may offer some advantages over surface contact engines if ways can be found to significantly improve their propellant utilization. Author

N63-10327 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
EXPERIMENTAL PERFORMANCE OF AN ION ROCKET ENGINE USING A RECTANGULAR-SLAB POROUS-TUNGSTEN EMITTER
Ronald J. Cybulski, Joseph T. Kotnik, and David L. Lockwood Washington, NASA, Nov. 1962 27 p 8 refs
(NASA TN D-1321) OTS: $0.75

An ion rocket engine using a porous-tungsten ionizer has been operated for more than 50 hours. The techniques of electron-beam welding and high-temperature-furnace brazing were used to assemble the ionizer. Accelerator and power efficiencies of 90 and 70 percent, respectively, were obtained at a current density of 113 amp/sq m. The power efficiency was obtained at a specific impulse of 8680 seconds. Preliminary results indicate a propellant utilization efficiency of about 90 percent. Author

N63-10341 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio
PLASMA ENGINES ION AND PHOTON ROCKET ENGINES
V. Kh. Abiants Oct. 11, 1962 13 p 4 refs Transl. from Reaktivnyye Dvigateli i Bol'shiye Skorosti, ser. 4, 1960 p 26–34
(FTD-TT-61-464/1+2+4)

Some of the theoretical aspects of the plasma, ion, and photon engines are reviewed for space applications. The plasmatron is an apparatus for creating a plasma stream which is directed by the use of an electric arc. In the design of the plasma engine the graphite nozzle can be quickly washed away and destroyed under the action of the high temperature stream. A charged stream, on the whole, has directed motion along the nozzle, but within this stream there is chaotic motion of ions and electrons with enormous velocities. If this particle motion is regulated, then the velocity of the charged stream can be greatly increased. This principle is the basis on which the ion and photon engines are built. J.R.C.

N63-10376 National Aeronautics and Space Administration, Washington, D.C.
RECOVERABLE SPACE LAUNCHING NUCLEAR SYSTEMS
Maxwell W. Hunter, Jr. *In* Air Force Systems Command Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif. Transactions of the 7th Symp. on Ballistic Missile and Space Technol., U. S. Air Force Academy, Colo., Aug. 13–16, 1962 Vol. 1 p 129–143 3 refs (See N63-10370 01-01)

Factors affecting the use of nuclear rockets in recoverable space launching systems are discussed. Energy requirements and consequently fuel costs are shown to be of the same magnitude as for terrestrial air transport systems. The ability of advanced nuclear propulsion to permit the recovery and re-use of airframes, and aid in the achievement of low refurbishment costs is discussed. Attention is directed toward certain items of safety, including some basic factors which might cause gaseous fission rockets to be more operationally safe than solid core units. The possible impact of economical space launching systems on national programs is considered. Author

N63-10377 Westinghouse Electric Corp. Astronuclear Lab., Large, Pa.
REUSEABILITY AND DISPOSAL OF NUCLEAR SYSTEMS IN SPACE
A. L. Bethel and J. H. Bach *In* Air Force Systems Command Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif. Transactions of the 7th Symp. on Ballistic Missile and Space Technol., U. S. Air Force Academy, Colo., Aug. 13–16, 1962 Vol. I p 145–166 3 refs (See N63-10370 01-01)

The problems of maintaining, refueling, and disposal of radioactive nuclear space systems are considered. The types and frequencies of different maintenance operations are estimated, as well as special problems affecting military systems. Design requirements to permit maintenance are outlined for propulsion and APU

reactors, together with a number of service schemes. Secondary applications for used radioactive components are described, and specific disposal orbits are recommended based on fission product activity and Van Allen Belt location. Author

N63-10383 Aerospace Corp. Systems Research and Planning Div., Los Angeles, Calif.
NUCLEAR PROPULSION FOR ORBIT-BASED SPACECRAFT
C. J. Wang *In* Air Force Systems Command Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif. Transactions of the 7th Symp. on Ballistic Missile and Space Technol., U. S. Air Force Academy, Colo., Aug. 13–16, 1962 Vol. I p 365–385 (See N63-10370 01-01)

A cost analysis is made for nuclear and chemical vehicles for orbit-based spacecraft to show the significant cost advantage of nuclear propulsion. Conversion laws for equivalent nuclear and chemical components are introduced to establish equitable vehicle performance comparison as a basis for the cost study. Some design considerations for spacecraft, including such factors as vehicle size and thrust-to-weight ratio, are also examined. Author

N63-10439 Rensselaer Polytechnic Inst., Troy, N. Y.
THE FLOW INDUCED BY A NEW TYPE OF SELF-PROPELLED VEHICLE IN A DUCT
Peter McGrath, John W. Burr, and William R. Adair Oct. 1962 32 p 5 refs
(Contract DA-ORD-31-124-61-G88)
(TR-AE-6204; AROD-2566-4)

An analysis is carried out to determine the magnitude of the flow velocities that are induced inside a tube in the presence of a vehicle which propels itself by the fore-to-aft transfer, at appropriate rates, of the fluid in the adjacent layers within the tube itself. A fixed schedule of accelerations of the vehicle is considered, with various tube end conditions. The greatest induced air velocities are produced if the tube is open at both ends. If the tube is closed at one or both ends, the induced air velocities are more than an order of magnitude lower. In an infinite or half-infinite tube the induced air velocities are greater than those produced in a closed tube, but still an order of magnitude lower than those produced in a tube open at both ends. Author

N63-10448 Air Force System Command. Foreign Technology Div., Wright-Patterson AFB, Ohio
SYNCHROPHASING OF PROPELLER BLADES OF MULTI-ENGINE AIRCRAFT BY AUTOMATION
O. B. Vlasov-Vlasuk Aug. 22, 1962 36 p 2 refs Transl. from the book "Avtomaticheskiye Regulirovaniye Aviadvigateli, Sbornik No. 4" Moscow, Oborongiz, 1962 p 3–4 and 70–94
(FTD-TT-62-1166/1+2)

The book deals with the problems connected with the analytical determination of the dynamic characteristics of the elements of power installations, methods of making mockups of random stationary disturbances, and methods of speeding up engines, etc. The book is intended for specialists who are working with problems of automatic control of power aviation and rocket units as well as problems in the theory of automatic control. Author

N63-10493 Aerojet-General Corp., Sacramento, Calif.
A STUDY OF ROCKET ENGINE SYSTEM RELIABILITY Final Report, Volume 1
James H. Madden Oct. 16, 1962 135 p 9 refs
(NASA Contract NASr-66)
(Rept. 0599-01F, Vol. 1)

A technique has been developed to predict the inherent reliability of liquid rocket engines. The technique is intended for use during the preproposal, proposal, and early development phases as a means of predicting the anticipated reliability increase for later phases of the development program. A mathematical model was developed to relate the component reliabilities to the system reliability. Results of an analysis of simulated missions with this technique indicate its versatility in predicting reliability under various missions. R.C.M.

N63-10494 National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
DEVELOPMENT OF THE LUNAR AND SOLAR DISTURBING FUNCTIONS FOR A CLOSE SATELLITE
William M. Kaula Repr. from Astron. J., v. 67, no. 5, June—No. 1300, 1962 p 300-303 9 refs Previously published as NASA TN D-1126; for abstract see N62-10032 01-12

The complete gravitational disturbing function

$$R = m^* \sum_{n=2}^{\infty} \frac{\rho^n}{\rho^{*n+1}} P_n(s)$$

is developed in the form

$$R = m^* \sum_{n,m,p,h,q,i} \frac{a^n}{a^{*n+1}} \frac{(n-m)!}{(n+m)!} F_{nmp}(i) F_{nmh}(i^*) H_{hpq}(e) G_{nhj}(e^*) \times \cos[(n-2p)\omega + (n-2p+q)M - (n-2h)\omega^* - (n-2h+j)M^* + m(\Omega-\Omega^*)],$$

where the functions *F*, *H*, *G*, are polynomials. It is felt that this form is advantageous when it is desired to conserve computer storage space, or to make changes in the terms to be included in the disturbing function, or to include the luni-solar perturbations in the same computation with perturbations due to tesseral harmonic terms of the earth's gravitational field. Also developed is a quasi-potential for the solar radiation-pressure effect for use in equations of motion written in terms of Keplerian elements. Author

N63-10514 Rice U., Houston, Tex.
THRUST FROM PARTLY IONIZED MONATOMIC GASES
Herbert Beckmann and Alan J. Chapman Repr. from ARS Journal, Sept. 1962 p 1369–1373 8 refs
(NASA Grant NsG-3-59)

A monatomic, partly ionized gas with uniform stagnation properties is considered flowing in thermal equilibrium through a converging-diverging nozzle. The relationship is established between critical mass flow density and the following stagnation properties: pressure, enthalpy, and degree of ionization. Based on this relationship, thrust output at the throat as well as at large nozzle expansion ratios has been analyzed for one-dimensional steady flow. For achieving the same nozzle efficiency, expansion ratios for the initially ionized gas have to be several orders of magnitude greater than in the case of conventional, un-ionized gases. The thrust output at the nozzle throat as compared to the maximum obtainable thrust, amounting to 80% in the un-ionized case, may be as low as 50% for the fully ionized gas. Author

28 SPACE RADIATION

Includes: cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts.

For related information see: 05 Astronomy and Astrophysics; 16 Life Sciences; and 29 Space Sciences.

N63-10104 Uppsala U. Inst. of Physics (Sweden)
STANDARD ERRORS OF COSMIC RAY DATA CORRECTED FOR ATMOSPHERIC EFFECTS
E. Dyring and S. Lindgren Jan. 1962 15 p 9 refs
(Contract AF 61(514)-1312)
(Tech. Note 10; AFCRL-62-651)

A formula is obtained for the standard error of cosmic ray data which have been corrected for atmospheric effects. It is used to estimate standard errors of the nucleonic and meson components corrected by different methods. The relative standard error is found to decrease with increasing counting rate up to an approximate value of 10^6 counts per time interval if simultaneous meteorological measurements are available for each recording interval. Above that counting rate, the relative standard error is essentially constant. Author

N63-10105 Uppsala U. Inst. of Physics (Sweden)
GEOPHYSICAL ASPECTS OF COSMIC RAYS. APPENDIX II: DIRECTION OF THE COSMIC RAY ANISOTROPY Final Report
Arne Eld Sandström, Eric Cyring, and Stig Lindgren Mar. 31, 1962 24 p 24 refs Appendix II is a reprint from Tellus XIV, 1 (1962) p 19–32
(Contract AF 61(514)-1312)
(AFCRL-62-652)

A survey is presented of the work performed by the Cosmic Ray Group. Some related items of research are summarized. A reprint is affixed containing a paper on the direction of the cosmic ray anisotropy. Author

N63-10106 Uppsala U. Inst. of Physics (Sweden)
STORM SUDDEN COMMENCEMENTS AND INCONSPICUOUS UNIVERSAL TIME VARIATIONS
Arne Eld Sandström and Oscar L. Troncoso Mar. 31, 1962 15 p 7 refs
(Contract AF 61(514)-1312)
(Tech. Note 11; AFCRL-62-674)

Very small Forbush decreases have been traced in the records from cosmic ray stations in Sweden and associated with storm sudden commencements. This is done to determine to what extent these inconspicuous decreases may account for storm sudden commencements and explain the difference in the number of storms and decreases. False phase shifts are discussed as they relate to studies of the phase and amplitude of the diurnal variation. R.C.M.

N63-10107 Uppsala U. Inst. of Physics (Sweden)
COSMIC RAY INTENSITY VARIATIONS DURING 1961
A. E. Sandstrom, D. Dyring, B. O. Grönkvist, and S. Lindgren Mar. 31, 1962 39 p
(Contract AF 61(514)-1312)
(Tech. (Sci.) Note 12; AFCRL-62-675)

The note consists mainly of tables of the first and second harmonics of the daily variation recorded during 1961 in Uppsala and Kiruna. The yearly mean daily variations are illustrated by dock diagrams. Only a few prominent Forbush decreases followed by cosmic ray storms were recorded during 1961. Diagrams illustrate the intensity variations in percent of a "normal" counting rate. One section and a couple of diagrams are devoted to the solar flare effects during July 1960. Author

N63-10117 Paris Observatory, Meudon (France)
Final Report [AFTERGLOW OF NITROGEN AND NITROGEN-INERT GAS MIXTURES]
L. Herman [1962] 7 p
([AF 61(052-17]; Grant AF-EOARDC-61-17)
(AFCRL-62-1010)

A summary is given of the main results obtained in the investigation of some primary emission processes, such as the afterglow of nitrogen due to atomic recombination and the nitrogen-inert gas mixtures afterglow (He + N_2) or (X + N_2). In relation to the problem of broadening of spectral lines by the statistical ionic field, the higher terms of the Stark effect shift for the first hydrogen Balmer lines have been calculated. Author

N63-10119 Kiruna Geophysical Observatory (Sweden)
STUDIES OF IONOSPHERIC ABSORPTION OF RADIO WAVES BY THE COSMIC NOISE METHOD Scientific Report No. 3
Bengt Hultqvist June 15, 1962 91 p 171 refs
(Contract AF 61(052)-601)
(AFCRL-62-1044)

The theory of measurements of nondeviative absorption of radio waves is reviewed. It is pointed out that the discrepancy between classical magnetoionic theory and generalized theory, in which the energy dependence of the electron collision frequency is taken into account, is appreciable in most of the lower ionosphere. It is also shown that the use of the generalized theory does not involve more work at the ordinary riometer frequencies than does the magnetoionic theory. The results of riometer measurements of quiet day absorption, sudden cosmic noise absorption, absorption associated with aurora and geomagnetic disturbances, and of polar cap absorption are reviewed. Special emphasis is placed on the problem of the variation of cosmic noise absorption in the twilight periods and the interpretation of the observations relevant to it. Author

N63-10221 Chicago U. Enrico Fermi Inst. for Nuclear Studies, Ill.
INTERPLANETARY DYNAMICAL PROCESSES: THE SOLAR WIND AND INTERPLANETARY FIELDS
E. N. Parker *In* Virginia Polytechnic Inst., Blacksburg. Physics of the Solar System, Part I. Proc. of the Conf. on Physics of the Solar System and Reentry Dynamics, July 31 to Aug. 11, 1961 p 23-38 31 refs (See N63-10220 01-05) VPI: $1.50

Hydrodynamic expansion of the solar corona is the basis for "solar corpuscular radiation." The quiet-day coronal temperatures of $1 - 2 \times 10^6$ ° K yield a solar wind of several hundred km/sec and a density of 5 – 50 particles/cm³ at the orbit of Earth. The solar wind draws out into space the lines of force of the general one gauss solar field, to give an interplanetary field that is basically spiral in character with a density of the order of a few times 10^{-4} gauss at the orbit of Earth. The enhanced corona may sometimes have temperatures of 4×10^6 ° K or more immediately following a large flare. Such explosive heating leads to a $1 - 2 \times 10^3$ km/sec blast wave into interplanetary space. The blast wave sweeps up the quiet-day solar wind ahead and kinks the quiet-day field, raising the density of the field to several times 10^{-4} gauss on some occasions. The galactic cosmic-ray particles are swept back by the kink, producing a Forbush-type intensity decrease. Altogether, the blast wave and its magnetic field constitute the "enhanced solar corpuscular radiation." It is shown that the alternative magnetic tongue model of Gold and others is untenable because the "tongue" would not reach Earth until many hours after the arrival of the blast wave. It is estimated that the supersonic solar wind extends into space to a distance of the order of 45 a.u. Stellar winds are expected to be a common phenomenon, and replace to Strömgren sphere for the cooler stars. Author

N63-10223 California U., Berkeley
ENERGETIC PARTICLE PRODUCTION BY SOLAR FLARES
Kinsey A. Anderson *In* Virginia Polytechnic Inst., Blacksburg. Physics of the Solar System, Part I. Proc. of the Conf. on Physics of the Solar System and Reentry Dynamics, July 31 to Aug. 11, 1961 p 67–72 (See N63-10220 01-05) VPI: $1.50

Energetic particle production by the sun is studied from the observed behavior of the cosmic rays near the earth and from a detailed study of the accompanying solar phenomena. The solar cosmic-ray spectrum is shown to be related to the size of the optical flare. The significance of solar cosmic rays is discussed as they relate to the general cosmic-ray problem. R.C.M.

N63-10237 Avco-Everett Research Lab., Everett, Mass.
RADIATION AND IONIZATION PROBLEMS IN RE-ENTRY
P. H. Rose *In* Virginia Polytechnic Inst., Blacksburg. Reentry Dynamics, Part II. Proc. of the Conf. on Physics of the Solar System and Reentry Dynamics, July 31 to Aug. 11, 1961 p 156–206 22 refs (See N63-10230 01-01) VPI: $2.00

The radiation and ionization problems encountered by a re-entry body are discussed. The gas radiation absorbed or reflected by the body or transmitted to the surroundings originate from the inviscid flow field, the boundary layer, the near wake or the far wake. Surface radiation can also be important because much of the heat transferred to the vehicle may be re-radiated by hot surfaces to the surroundings. Radiation may be an important consideration because it produces heating of the vehicle, it affects the performance of heat shield materials, either ablating or otherwise, or it may be a useful observable effect which can be utilized in testing or by a defensive system. The problems associated with both equilibrium and nonequilibrium radiation are reviewed. J.R.C.

N63-10369 National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE MAGNETIC FIELD OF A MODEL RADIATION BELT NUMERICALLY COMPUTED
Joseph C. Cain, Syun-Ichi Akasofu, and Sydney Chapman (Alaska, U.) Washington, NASA, Nov. 1962 22 p 18 refs Previously processed as reprint; for abstract see N62-11139 04-12
(NASA TN D-1447) OTS: $0.75

The magnetic field of a ring-current belt symmetrically encircling the earth is calculated numerically, to a first approximation, for a particular model belt. The whole distribution of the field is discussed, and, for a particular intensity of the belt, the calculation is carried to a second approximation. The field of the ring current is shown to be nearly uniform over the earth's surface, although the diamagnetism of the belt produces an insignificant irregularity in the field disturbance in auroral latitudes. In the model belt considered, the center line is connected with the auroral zone by the dipole field lines of force. Although its particles have not yet been observed directly, its existence is suggested by the quiet day anomaly of the satellite-observed magnetic field at six earth radii.
Author

N63-10487 Iowa State U., Iowa City
GEOMAGNETICALLY TRAPPED RADIATION PRODUCED BY A HIGH-ALTITUDE NUCLEAR EXPLOSION ON JULY 9, 1962
B. J. O'Brien, C. D. Laughlin, and J. A. Van Allen Repr. from Nature (London), v. 195, no. 4845, Sept. 8, 1962 p 939-943 7 refs
(NASA Grant NsG-233-62)

This is a preliminary report of investigations made with the satellite *Injun I* of the artificial radiation belt produced by a nuclear device recently exploded at a high altitude. For every kiloton fission explosion in the device, there were produced about 10^{23} fission nuclei the radioactive decay of which yielded some 5×10^{23} electrons having, presumably, a differential number energy spectrum approximated by $3{\cdot}88 \exp(-0{\cdot}575E - 0{\cdot}055E^2)$, for the range $1 \leq E \leq 7$ Mev, where E is the β-ray energy in Mev, and the spectral expression is in units of β-rays per fission per Mev. Some of these electrons were injected at such pitch angles to the geomagnetic field vector that they were temporarily trapped, executing oscillatory motion in latitude along magnetic field lines and drifting eastward in longitude to form an artificial radiation belt encircling the earth. This is the first reported case of a significant, artificial injection of durably trapped particles into the geomagnetic field since the *Argus* tests of 1958. Author

N63-10490 Air Force Cambridge Research Labs. Geophysics Research Directorate, Bedford, Mass.
SOME SYNOPTIC FLARE DATA, 1937–1960
Henry J. Smith Aug. 1962 44 p 17 refs
(AFCRL 62-827; Sacramento Peak Obs. Contrib.-39)

After suitable correction, observed monthly incidence of flares is tabulated. Hours of effective patrol must be calculated from hours of actual patrol. Flare incidence thus found is correlated moderately well with sunspot number and with the rate of formation of new active regions. The same analysis also provides information on the relative frequency of flares of different importance. Kleczek's importance duration index q is given for the months of the IGY and compared with other flare activity indices. The apparent average durations of flares change secularly, but this undoubtedly is the result of improving methods of observation.
Author

N63-10554 National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ARTIFICIAL RADIATION BELT DISCUSSED IN SYMPOSIUM AT GODDARD SPACE CENTER
W. N. Hess and Paul Nakada Repr. from Science, Oct. 5, 1962 p 53-54 2 refs

A summary is given of the data collected on the artificial radiation belt produced by the 1.4 megaton nuclear explosion above Johnson Island. The new belt is composed principally of the electrons produced by the decay of fission fragments from the explosion. These electrons possess energies up to about 8 Mev, with about half of them being below 1 Mev. Synchrotron radiation from the trapped electrons was observed in the 18 to 120 Mcy/sec range at observatories near the geomagnetic equator. Data on solar cell damage from four satellites indicate a density between 1×10^{13} and 6×10^{13} electrons per square centimeter. R.C.M.

29 SPACE SCIENCES

Includes: space chemistry; cosmology; lunar and planetary exploration; and theoretical analysis of orbits and trajectories.

For related information see: 05 Astronomy and Astrophysics; 12 Geophysics; and 22 Navigation and Guidance.

For space biology see: 16 Life Sciences.

N63-10001 Max-Planck-Institut für Physik und Astrophysik, Munich (W. Germany)
PLASMA IM INTERPLANETARISCHEN RAUM [PLASMA IN INTERPLANETARY SPACE]
L. Biermann [1962] 10 p In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9–11, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 1) Available from WGL, Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

This paper lists a number of possible methods that might be used to determine the constitution of interplanetary space. A discussion of known phenomena then follows, along with analogies that might be drawn from these facts. Observations made in the past, that might have bearing on the present questions, are reviewed. Experiments are suggested which might clarify some of the unknowns. One such suggested experiment is derived from fundamentals provided by "Comet Physics," apart from the direct measurement of plasma flow and magnetic fields. It is concluded that the combination of astronomical observations with direct measurements and the more indirect observation methods lead to a consistent picture of the typical constitution of interplanetary space. A.S.

N63-10118 Deutsche Bundespost. Ionosphären-Institut Breisach (W. Germany)
SOLAR AND LUNAR TIDES IN THE DRIFT OF THE E REGION Scientific Report No. 1
E. Harnischmacher June 30, 1962 21 p 4 refs
(Contract AF 61(052)-81)
(AFCRL-62-1031)

By systematic statistical treatment of a large number of observations, standard seasonal drift diagrams for the E region are obtained. Individual groups of days are compared with the standards. This is done for the prevailing component as well as the 12 h rotational component. In this way, it could be stated that the declinations of sun and moon have an important and rather similar influence on both components. Author

N63-10122 Queen's U., Belfast (Gt. Brit.)
TEMPERATURE DETERMINATION FROM A CLOUD OF ALKALI VAPOUR IN THE UPPER ATMOSPHERE
G. T. Best and T. N. L. Patterson [1962] 26 p 43 refs
(Grant AF-EOARDC 61-16)
(AFCRL-62-1049)

A new method is discussed for measuring the temperature in an artificial cloud of alkali vapor. This method overcomes the complications introduced by the process of self-absorption. Estimates of the intensities of the relevant emission lines to be observed are made. It is concluded that observations made on lithium vapor present the best means of measurement. Author

N63-10142 Armour Research Foundation, Chicago, Ill.
RADIATIVE ENERGY TRANSFER ON ENTRY INTO MARS AND VENUS Quarterly Report No. 3
William O. Davies Sept. 1962 53 p 13 refs
(NASA Contract NASr-65(00))
(ARF-1200-3) OTS: $5.60 ph, $1.79 mf

Emission spectra of the molecular species present in the atmospheres of Mars and Venus are determined to provide quantitative information for evaluation of the radiative heating of probes entering these atmospheres. Values of emission intensity from carbon dioxide and nitrogen mixtures are given, along with spectra for the infrared emission of carbon dioxide and ultraviolet, and visible emission of carbon monoxide. R.C.M.

N63-10143 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
THE EFFECT ON THE LUNAR ORBIT OF METEORITIC ACCRETION
R. A. Lyttleton Sept. 1962 Repr. from Icarus, v. 1, no. 2, Sept. 1962 p 137–143 2 refs
(NASA Contract NAS7-100)
(JPL-TR-32-293)

The assumption that the range of the lunar orbit has been influenced only by tidal dissipative effects may not be valid, for there is the further possibility that considerable change in mass of both the Moon and Earth has resulted through meteoritic accretion during the past 4 to 5 aeons, and this would operate to make the orbit contract. The effect of such addition of mass is greater for the Moon at greater distance, whereas the tidal couple on the Moon decreases very rapidly with distance. Examination of the hypothesis opens the possibility that the Moon may have been captured at substantially greater distance than the present one and thereafter drawn in towards the Earth. Author

N63-10245 Jet Propulsion Lab., Calif., Inst. of Tech., Pasadena
SPECTROSCOPIC TEMPERATURE AND PRESSURE MEASUREMENTS IN THE VENUS ATMOSPHERE
Hyron Spinrad Repr. from Publ. Astron. Soc. Pacific, v. 74, no. 438, June 1962 p 187-201 15 refs
(NASA Contract NAS7-100)
(JPL-TR-32-251)

Spectroscopic observations of the Venus carbon dioxide band at λ7820 have allowed us to probe Venus atmosphere. The mean depth of penetration apparently varies irregularly; occasionally the CO_2 absorption originates in a region with $T \approx 440°$ K, $P \approx 5$ atm. The surface conditions must be considerably more extreme. From the partial pressure of CO_2 derived from the equivalent CO_2 path needed to give the Venus λ7820 band and the total base pressure, a CO_2 abundance of about 4% has been obtained. Author

N63-10251 National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THE MANNED LUNAR MISSION
Robert R. Gilruth and Maxime A. Faget N. Y., Am. Rocket Soc. [1962] 6 p Presented at the ARS Lunar Missions Meeting, Cleveland, July 17–19, 1962
(ARS Paper-2464-62) ARS: $0.50 members, $1.00 nonmembers

The requirements imposed by a manned lunar mission are presented, and the current plans for meeting these requirements are reviewed, based on experience gained with Project Mercury orbital flights. The lunar orbit rendezvous method has been selected as the preferred method of achieving the objectives of Project Apollo, which are to land men on the moon, to explore the local vicinity, and to return the men. The characteristics of the lunar rendezvous approach are: a special spacecraft is used for landing on the moon; the total mass that must be boosted to escape velocity is greatly reduced; and a minimum amount of new hardware is required. Technical challenges posed by the Apollo mission include: (1) problems of vital maneuvers and operations to be carried out a quarter of a million miles away; (2) the implicit requirement for real time navigation utilizing equipment that must operate from within the spacecraft; (3) the repeated and critical dependence on the various propulsion systems throughout the mission; and (4) the protection of the crew from the lunar surface environment during exploration. M.P.G.

N63-10329 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE INFLUENCE OF PRECESSION OF EARTH RENDEZVOUS ORBITS ON LUNAR MISSION REQUIREMENTS
William R. Wells Washington, NASA, Nov. 1962 29 p 4 refs
(NASA TN D-1512) OTS: $0.75

A study has been made to determine the influence of precession of an earth rendezvous orbit due to the earth's oblateness on lunar mission requirements. The nature of the regression along the earth-moon plane of the nodal line formed by the intersection of the earth rendezvous orbital and earth-moon planes is investigated. This investigation applies for the years 1964 to 1972. With this regression taken into account, two methods for correcting for more than anticipated delay times in earth orbit are considered. The two methods considered are a plane change and an increase in injection velocity. Results of the two methods indicate that the plane-change technique requires considerably less additional velocity. Based on the results of the analysis, launch windows corresponding to lunar positions or declinations throughout the month are presented. Author

N63-10334 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE PROGRAMS SUMMARY NO. 37-17, VOLUME VI FOR THE PERIOD JULY 1, 1962 TO OCTOBER 1, 1962. SPACE EXPLORATION PROGRAMS AND SPACE SCIENCES
Oct. 31, 1962 67 p 5 refs
(NASA Contract NAS7-100)
(JPL Space Programs Summary 37-17, Vol. VI) OTS: $6.60 ph, $2.21 mf

This report covers the space exploration programs and space sciences as follows: the Ranger, Surveyor, Mariner, and Voyager Projects; the DSIF tracking of Mariner 2; geophysical instruments for lunar exploration; television subsystems for planetary studies; and a study of the Odessa iron meteorite. R.C.M.

N63-10335 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena, Calif.
THE COMPOSITE ORIGIN OF HEAVY ELEMENTS AND IRON METEORITES
Royal R. Marshall Repr. from Icarus, v. 1, no. 2, Sept. 1962 p 95-111 43 refs
(NASA Contract NAS7-100)
(JPL-TR-32-264)

A model based on three nucleosynthesizing events preceding the formation of the solar system accounts for the origin of the r-process nuclides. The first such production occurred 13.4 × 10^9 years ago. It may represent an average of more than one such nuclear synthesizing event (but probably not many such events). The second event occurred 7.5 × 10^9 years ago, and the third occurred at the beginning of the solar system. The last two events contributed only 6% and 7%, respectively, of the r-process elements to the meteorites and planets. (These values do not necessarily include those elements, such as lead and bismuth, which are quite volatile and easily fractionated by physical and chemical means.) The range in the lead-lead ages of the stone meteorites seems to be about 0.3 × 10^9 years. This interval essentially coincides with that of 0.25 × 10^9 years between the last nucleosynthesis and the time at which the chondrite Richardton began to retain rare gases such as xenon. According to the abundance of XE^{136} in the atmosphere, the earth may have formed as recently as 4.2 × 10^9 years ago. The three-nucleosynthesizing-event model was suggested by the presence of two kinds of lead which must have been incorporated into iron meteorites at or before the beginning of the solar system. Three iron meteorites (Toluca, Bishtyube, and Henbury) contain both types, a fact which implies that there were at least two stages in the formation of these meteorites. First, iron must have been segregated from two sources which differed at least in the isotopic composition of their leads; then these masses of iron must have combined, with more or less complete sintering. Author

N63-10372 Armour Research Foundation, Chicago, Ill.
PENETRATION STUDIES OF SIMULATED LUNAR DUST
R. D. Towe and E. T. Selig *In* Air Force Systems Command. Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif. Transactions of the 7th Symp. on Ballistic Missile and Space Technol., U.S. Air Force Academy, Colo., Aug. 13-16, 1962 Vol. I p 53-72 3 refs (See N63-10370 01-01)

Results are presented for the static and dynamic penetration resistance of a simulated lunar dust in a hard vacuum environment. Specimens of finely ground silica, covering a range of densities, were tested at a number of absolute pressures from one atmosphere down to 5 x 10^{-6} torr. While the nature of their behavior was somewhat different, both static and dynamic penetration resistance were found to depend significantly on initial specimen density and on vacuum levels, increasing with an increase in density or a decrease in pressure. Author

N63-10373 Aerospace Medical Div., School of Aerospace Medicine, Brooks AFB, Tex.
STERILIZATION OF ELECTRONIC COMPONENTS OF SPACECRAFT
Joseph T. Cordaro and E. Staten Wynne *In* Air Force Systems Command. Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif. Transactions of the 7th Symp. on Ballistic Missile and Space Technol., U. S. Air Force Academy, Colo., Aug. 13–16, 1962 Vol. I p 73–82 10 refs (See N63-10370 01-01)

Contamination of celestial bodies with earth microorganisms might make studies of any extraterrestrial life impossible. Sterilization of heat and/or radiation sensitive electronic components presents a special problem. Using a flexible film germ-free isolator, internal contamination was demonstrated in only 11 of 166 components, including 9 of 101 capacitors. Moreover, the level of natural contamination is low and destruction of microorganisms is assessed in terms of probability. Therefore, development of adequate sterilization procedures is being approached by deliberate contamination, during manufacture, with bacterial spores of high resistance to heat and irradiation. The results obtained with some types of resistors and diodes are presented. Author

N63-10374 Lockheed-California Co., Burbank
PERFORMANCE AND ABORT CONSIDERATIONS AFFECTING THE SELECTION OF INJECTION CONDITIONS FOR EARTH-MOON TRAJECTORIES
Jim Rogers Thompson *In* Air Force Systems Command. Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif. Transactions of the 7th Symp. on Ballistic Missile and Space Technol., U. S. Air Force Academy, Colo., Aug. 13–16, 1962 Vol. I p 83–101 5 refs (See N63-10370 01-01)

The results of a brief study of the considerations affecting the selection of injection conditions for manned Earth-Moon flights are presented herein. It is shown that injection conditions maximizing the systems useful payload are considerably changed by the addition of abort provisions. The implications of the results on the selection of vehicle design characteristics and operational procedures are discussed through use of an example based on the Apollo system. Author

N63-10375 General Dynamics/Ft. Worth. Nuclear Aerospace Research Facility, Tex.
A PROCEDURE FOR CALCULATING RADIATION EXPOSURE ON SPACE MISSIONS
R. A. Miller and W. Cranford *In* Air Force Systems Command. Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif. Transactions of the 7th Symp. on Ballistic Missile and Space Technol., U. S. Air Force Academy, Colo., Aug. 13–16, 1962 Vol. I p 103–127 9 refs (See N63-10370 01-01)
(Contract AF 33(657)-7201)

A problem associated with manned space missions is the determination of shielding requirements for the protection of man from the hazards of space radiation. A space trajectory radiation exposure has been formulated for estimating the magnitude of this radiation for missions in cislunar space. The results are described for some calculations of the dose incident on a vehicle subjected to trapped radiation, cosmic radiation, and a solar-flare radiation during a lunar mission of about seven days. Author

N63-10403 Air Proving Ground Center, Elgin AFB, Fla.
EQUATORIAL ORBITS OF A SATELLITE IN THE GRAVITATIONAL FIELD OF A SPHEROID [Final] Technical Documentary Report
G. B. Findley and P. M. Fitzpatrick Nov. 1962 21 p 6 refs
(APGC-TDR-62-65)

A precise expression has been obtained for the equatorial orbits of a small satellite moving in the gravitational field of a spheroid which possesses equatorial and rotational mass symmetry. For earth satellite orbits, the results can be applied over the entire range of values of the eccentricity, e, of the unperturbed elliptic motion. The radial distance from the spheroid's center to the satellite is expressed as a periodic function in the true anomaly, complete to the seventh order in a small dimensionless parameter ϵ. For bound geoidal orbits, the parameter ϵ is less than 0.033 for all values of e. The potential used to represent the spheroid includes the sixth harmonic. The solution contains three adjustable constants which permit the coefficients of the second, fourth, and sixth harmonics in the potential to be fitted to observational data. Author

N63-10404 Air Proving Ground Center, Elgin AFB, Fla.
CRITERIA FOR SCHROEDINGER SEPARABILITY APPLIED TO SATELLITE ORBIT THEORY [Final] Technical Documentary Report
P. M. Fitzpatrick and G. B. Findley Nov. 1962 17 p 8 refs
Presented at the Seventh Annual ARDC Science and Engineering Symp., Boston, Nov. 1960; and at the First Intern. Symp. on Analytical Astrodynamics, Los Angeles, June 1961
(APGC-TDR-62-67)

It may be timely to point out that certain criteria for separating the Schroedinger wave equation of quantum mechanics will also

permit separation of the Hamilton-Jacobi equation of classical mechanics. In particular, a potential which leads to separability under these criteria must have the same functional form for either equation. The most general axially symmetric gravitational potential which permits Hamilton-Jacobi separability in spherical coordinates is found to be the sum of the zeroth and first spherical harmonics. This result is discussed in relation to several other gravitational potentials which have been used in artificial satellite orbit studies. Author

N63-10408 Aerospace Information Div., Library of Congress, Washington, D. C.
REVIVED INTEREST IN F. A. TSANDER'S WORK ON SPACE FLIGHT
Nov. 13, 1962 3 p Review of: F. A. Tsander The problem of flight with the aid of reaction vehicles; interplanetary flights Moscow, Oborongiz, 1961 459 p; and L. Korneyev Scout of the spaceways Aviats. i Kosmonavt. (Moscow), v. 45, no. 8, 1962 p 26–31
(AID-62-179) OTS: $1.10 ph, $0.80 mf

Revived interest in F.A. Tsander's work on space flight is focused on the following: use of electrostatic force; use of magnetic force; use of solar energy; generation of solar attraction; and protection from meteors and dust. J.R.C.

N63-10427 National Aeronautics and Space Administration, Washington, D. C.
MAGNETIC FIELDS IN SPACE
Charles P. Sonett Repr. from Astronautics, Aug. 1962 p 34–39 3 refs

The data obtained from space probes on the magnetic fields is reviewed and related to the present knowledge of these fields and the solar plasma. The instrumentation used in these probes is described. R.C.M.

N63-10495 National Aeronautics and Space Administration, Washington, D. C.
THE CHALLENGE OF SPACE EXPLORATION
Robert C. Seamans, Jr. Washington, Smithsonian Institution, 1962 Repr. from the Smithsonian Report for 1961 p 263–274 Presented at the Air Force/Aerospace Corp. Symp. on Ballistic Missile and Aerospace Technology, Los Angeles, Aug. 29, 1961
(Smithsonian Publ. 4481)

This report covers the following: why the space program must be accelerated; direct applications of space research; risks involved in delay; and unmanned and manned space flight. J.R.C.

N63-10496 National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CALCULATION OF THE ECLIPSE FACTOR FOR ELLIPTICAL SATELLITE ORBITS
Fred G. Cunningham Repr. from ARS Journal, Sept. 1962 2 p 2 refs Previously published as NASA TN D-1347; for abstract see N62-13231 09-09

A convenient and direct method is given for determining the eclipse factor, i.e., the fraction of an orbital period μ a satellite spends in the shadow of earth. The method is applicable to elliptical orbits for arbitrary values of the angle between the solar vector and the orbital plane and the orientation of the line of apsides. Author

N63-10508 Smithsonian Astrophysical Observatory, Cambridge, Mass.
SATELLITE ORBITAL DATA
I. G. Izsak Aug. 28, 1962 48 p
(NASA Grant NsG-87-60)
(SAO Special Rept.-103) OTS: $4.60 ph, $1.64 mf

This report present SOA mean elements derived from observations covering several days for the Vanguard III and the Echo I satellites. The tabulated values of the SAO mean elements give the values of arguments of perigee, right ascension of the ascending mode, inclination, eccentricity, and mean anomaly as functions of time expressed in days. J.R.C.

N63-10509 Smithsonian Astrophysical Observatory, Cambridge, Mass.
CATALOG OF PRECISELY REDUCED OBSERVATIONS, NO. P-5
Jean E. MacDonald and Katherine Haramundanis Aug. 27, 1962 45 p 4 refs
(NASA Grant NsG-87-60)
(SAO Special Rept.-102) OTS: $4.60 ph, $1.55 mf

This catalog includes 1,670 observations of Satellite 1959 (Vanguard II). The time accuracy of the observations depends primarily on the stability of the station clock and on the reception of the time signals. Uncertainties have been estimated according to these criteria; they vary from ±0.5 msec to ±20 msec, with an average value of ±2 msec. J.R.C.

N63-10510 Smithsonian Astrophysical Observatory, Cambridge, Mass.
NUMERICAL RESULTS FROM ORBITS
Yoshihide Kozai July 31, 1962 24 p 18 refs Presented at the Symposium on the Use of Artificial Satellites for Geodesy, Wash., D. C., U. S. Naval Observatory, Apr. 26–28, 1962
(NASA Grant NsG-87-60)
(SAO Special Rept.-101) OTS: $2.60 ph, $0.92 mf

This paper reviews recent results derived from orbits of artificial satellites in the field of geodesy and reports new values of coefficients of zonal harmonics in the potential of the earth. The review concentrates on the numerical results derived by dynamical methods, and emphasizes the determination of constants associated with the zonal and tesseral harmonics in the potential of the earth derived from variations of the orbits of the artificial satellites. Author

30 SPACE VEHICLES

Includes: launch vehicle—spacecraft combinations; operating problems; and stability and control.

For manned space capsules, satellites, and space probes see: 32 Space Vehicles (Spacecraft).

For boosters and rockets see: 31 Space Vehicles (Launch Vehicles).

For related information see: 04 Aircraft; 08 Communications; and 22 Navigation and Guidance.

N63-10036 Deutsche Versuchsanstalt für Luft- und Raumfahrt Inst. für Steuer- und Regeltechnik, Oberpfaffenhofen (W. Germany)
EINIGE UNTERSUCHUNGEN ZUR STEURUNG DES BLACK-PRINCE PROJEKTES [SOME INVESTIGATIONS CONCERNING THE GUIDANCE OF THE BLACK-PRINCE PROJECT]
A. Kutzer and U. Schwellinger Sept. 1962 19 p 3 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9–12, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 40) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

A study is made of the third stage booster used in conjunction with Bluestreak—as the first stage—to place satellites into orbit.

The various assignments will be carried out by maintaining a constant total weight of the third stage by means of varying the ratio of useful load to fuel. Of special interest is the effect of such an engine design upon the guidance in the ascent and insertion (into orbit) phases. A.S.

N63-10079 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
NUCLEAR-ELECTRIC SPACECRAFT CONCEPTS FOR UNMANNED PLANETARY EXPLORATION
Robert J. Beale Repr. from IRE Trans. on Space Electronics and Telemetry, v. SET-8, no. 2, June 1962 p 178-182 9 refs
(NASA Contract NAS7-100)
(JPL-TR-32-303)

The utilization of advanced, high-powered nuclear-electric spacecraft in the near future for the unmanned scientific exploration of space will provide significant weight allowances and power levels for scientific payloads and communication equipment. The electronic system designer, presently faced with minimum weight and power limitations imposed by today's chemically propelled spacecraft, must develop new techniques to take advantage of the greater capabilities promised by nuclear-electric spacecraft. Power levels approaching 1 Mwe may be expected. Systems capable of employing this power must operate under an intense nuclear radiation flux at elevated temperatures for long time periods. Development of such equipment must be initiated at an early date. Author

N63-10231 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
REENTRY VEHICLES: GENERAL CONCEPTS AND OPERATIONAL MODES
Eugene S. Love *In* Virginia Polytechnic Inst., Blacksburg Reentry Dynamics, Part II. Proc. of the Conf. on Physics of the Solar System and Reentry Dynamics, July 31 to Aug. 11, 1961 p 16–52 (See N63-10230 01-01) VPI: $2.00

This series of six lectures touches upon the major factors influencing reentry vehicle design and attempts to categorize reentry vehicles in classes according to their structural, material, and aerodynamic characteristics. In addition, a few special problem areas are discussed, and likely trends of future vehicles are indicated. Most of the material included in these lectures is of NASA origin; however, some material is taken from, or mixed with, material from other sources—such as studies by members of industrial organizations and laboratories. General acknowledgement is given to studies by staff members of Convair, General Electric, Cornell, Bell, Boeing, AVCO, Martin, Ryan, and Goodyear. Author

N63-10378 General Electric Co. Space Sciences Lab., Philadelphia, Pa.
AN EXPERIMENTAL EVALUATION OF SEVERAL ATTITUDE CONTROL CONCEPTS
Clarence J. Harris and Robert H. Johnson (GE Res. Lab., Schenectady, N.Y.) *In* Air Force Systems Command Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif. Transactions of the 7th Symp. on Ballistic Missile and Space Technol., U. S. Air Force Academy, Colo., Aug. 13–16, 1962 Vol. I p 169–210 36 refs (See N63-10370 01-01)

Several attitude-control concepts have been considered for providing hypersonic reentry vehicles with maneuvering capabilities. The attitude-control concepts experimentally evaluated here involve the application of movable structures—fins, flaps and rods—located on the surface of axisymmetric ballistic-type reentry vehicle models. Prior to considering these models with control surfaces, experimental studies were conducted to determine the static stability characteristics of, and shock layer properties about, the bodies without controls. Similar studies were then conducted on these bodies with controls present. Also evaluated was a magnetohydrodynamic concept for generating attitude-control forces. Author

N63-10379 Planning Research Corp., Los Angeles, Calif.
BALLISTIC MISSILE DECOY OPTIMIZATION THROUGH DYNAMIC PROGRAMMING
Y. Fukuda, W. E. Faragher, L. L. Philipson, and M. S. Schaeffer *In* Air Force Systems Command Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif. Transactions of the 7th Symp. on Ballistic Missile and Space Technol., U. S. Air Force Academy, Colo., Aug. 13–16, 1962 Vol. I p 237–253 (See N63-10370 01-01)

This paper presents a method for determination of optimum ballistic missile reentry decoy specifications through a dynamic programing model of the terminal battle. In this model the defense, given any fixed reentry decoy package specifications and discrimination decision rules, makes an optimized assignment of defense interceptor missiles (such as Nike Zeus) to the "apparent" warheads discriminated in a sequence of attacking missile clouds, so that the expected number of surviving warheads over the total number of clouds, E, is minimized. Then the defense determines the particular discrimination decision rules which minimize E, given the fixed offense decoy package. Finally, the offense selects the particular decoy specification which is optimal in that it maximizes, under payload size and weight constraints, the defense-minimized values of E. The optimal defense decision and interceptor assignment rules derived are real-time implementable. The optimized decoy package specifications are in terms of number, dimensions, weight, and discriminable parameters meaningful for design implementation. Author

N63-10384 Aerospace Corp., Engineering Div., Los Angeles, Calif.
MISSILE DESIGN FOR THE EFFECTS OF WINDS ALOFT
D. C. Bakeman. *In* Air Force Systems Command Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif. Transactions of the 7th Symp. on Ballistic Missile and Space Technol., U. S. Air Force Academy, Colo., Aug. 13–16, 1962 Vol. I p 387–427 11 refs (See N63-10370 01-01)
(Contract AF 04(695)-69)

A major problem in the design of large booster missiles is the proper consideration of the effects from winds aloft. Since wind magnitude and direction are statistical in nature, the problem can only be solved by the use of statistical techniques. This report suggests that the design requirement be a given probability of failure or launch delay due to winds aloft, or an optimization between cost (in terms of weight, schedules, etc.) and the probability of failure or launch delay. A methodology is then presented, along with pertinent background information and discussion, for designing to any of those requirements. Also presented is a procedure for a prelaunch wind check in which wind effect magnitudes are predicted for a flight. Author

N63-10392 Douglas Aircraft Co., Inc. Missile and Space Systems Div., Santa Monica, Calif.
SATELLITE INERTIA-WHEEL ATTITUDE CONTROL ON ELLIPTICAL ORBITS
M. J. Abzug *In* Air Force Systems Command Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif. Transactions of the 7th Symp. on Ballistic Missile and Space Technol., U.S.A. U. S. Air Force Academy, Colo., Aug. 13–16, 1962 Vol. II p. 89–114 6 refs (See N63-10389 01-01)

An investigation is made of the attitude-control characteristics of a satellite on an elliptical orbit when the attitude-control system consists of three inertia wheels in a closed-loop arrangement. A two-part perturbation analysis of the system is made. First, a reference-motion solution is obtained. This is a particular solution of the nonlinear equations of motion in which body axes coincide with reference axes. Then, perturbations from the reference motion are analyzed. The reference-motion solution is used to minimize the peak inertia-wheel speeds incurred in following nonuniformly rotating reference axes on an elliptical orbit. An undamped oscillation of very long period that varies with position on orbit is

found in the perturbation analysis. The existence of this oscillation is verified in the solution of the complete equations of motion by numerical analysis. A comparison of the numerical results with perturbation theory predictions shows that the motions following realistic injection errors are very little affected by nonlinearities in the equations of motion and coordinate transformations. Author

N63-10555 National Aeronautics and Space Administration, Washington, D. C.
SPACE APPLICATIONS
Morton J. Stoller Repr. from AIBS Bull., v. 12, no. 5, Oct. 1962 p 61-63

The Office of Applications of the National Aeronautics and Space Administration (NASA) operates in three major areas: meteorology, communications, and future applications. To achieve these objectives, NASA is currently pursuing three program approaches, represented by the Tiros, Nimbus, and Aeros satellites. The present status of each of these systems is discussed. R.C.M.

31 SPACE VEHICLES (LAUNCH VEHICLES)

Includes: boosters; clustered rockets; and multistage rockets.

For propulsion engines see: 27 Propulsion.

For manned space capsules, satellites, and space probes see: 32 Space Vehicles (Spacecraft).

For launch vehicle - spacecraft combinations see: 30 Space Vehicles.

For related information see: 04 Aircraft; 08 Communications; and 22 Navigation and Guidance.

N63-10232 National Aeronautics and Space Administration, Washington, D. C.
ROCKETS IN OUR SPACE PROGRAM
Abraham Hyatt *In* Virginia Polytechnic Inst., Blacksburg Reentry Dynamics, Part II. Proc. of the Conf. on Physics of the Solar System and Reentry Dynamics, July 31 to Aug. 11, 1961 p 53-74 (See N63-10230 01-01) VPI: $2.00

The rockets for launch vehicles that are employed in our space programs are described. The discussion is divided into four parts. The first portion deals with the basic components of rocket engines. It is followed by a short discussion of the performance of rockets, the parameters involved, the effects of injection trajectories and staging on the ultimate performance. The third section discusses the numbers, kinds and general characteristics of a number of U. S. launch vehicles. Finally, some estimates of future requirements for very difficult missions are made. Author

N63-10390 General Dynamics/Astronautics, San Diego, Calif.
SATELLITE BOOSTER CONTROL
A. F. Schmitt *In* Air Force Systems Command. Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif. Transactions of the 7th Symp. of Ballistic Missile and Space Technol., U.S. Air Force Academy, Colo., Aug. 13-16, 1962 Vol. II p 3-31 27 refs (See N63-10389 01-01)

Boost of a satellite payload through the atmosphere by a rocket-propelled vehicle poses severe flight-control problems. The general problem is reviewed with respect to the current level of technology, and a group of contemporary control configurations is described. These lead to the integrated all-digital autopilot-guidance system. The philosophies of incorporation of self-adaptive control and of configurations with redundant elements are discussed to indicate trends in forthcoming designs. Author

N63-10394 Martin Co., Baltimore, Md.
MANNED CONTROL OF LARGE SPACE BOOSTERS
F. A. Muckler, R. O. Hookway, and H. H. Burke *In* Air Force Systems Command. Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif. Transactions of the 7th Symp. on Ballistic Missile and Space Technol., U. S. Air Force Academy, Colo., Aug. 13-16, 1962 Vol. II p 149-188 15 refs
(See N63-10389 01-01)

To establish initial boundaries of pilot participation during the boost phase of a manned space vehicle, two modes of pilot performance were investigated: the insertion of his control signals into (1) the booster flight controls loop and (2) the guidance loop. First, flight control loop stability was analyzed using a mathematical approximation to describe the pilot. Results were evaluated on the basis of the Nyquist criterion for stability, permitting a preliminary estimation of pilot capabilities. Then the results were subjected to an empirical check. A cockpit mockup, equipped with essential instrumentation and controls, was connected to an analog computer simulation of the dynamics of the air vehicle during boost flight. Several test pilots flew the simulator at various flight conditions to explore operation in both modes. The results justify the basic conclusion that, for the postulated vehicle, there is a high probability that the pilot can perform adequately in either the control or the guidance loops during both stages of boost flight. Author

32 SPACE VEHICLES (SPACECRAFT)

Includes : manned space capsules; satellites and space probes.

For boosters and rockets see: 31 Space Vehicles (Launch Vehicles).

For launch vehicle - spacecraft combinations see: 30 Space Vehicles.

For related information see: 04 Aircraft; 08 Communications; and 22 Navigation and Guidance.

N63-10130 Aerospace Medical Div. Aerospace Medical Research Labs. (6750th), Wright-Patterson AFB, Ohio
WEIGHTLESS MAN: SINGLE-IMPULSE TRAJECTORIES FOR ORBITAL WORKERS [Final Report]
Donald D. Mueller and John C. Simons Behavioral Sciences Lab., Sept. 1962 13 p 2 refs
(AMRL-TDR-62-103) OTS: $0.50

While performing maintenance and assembly tasks outside of space vehicles under weightless conditions, a worker may accidentally propel himself away from his vehicle. To determine the speed of such a single-impulse launch, subjects under weightless conditions in a zero-G KC-135 aircraft propelled themselves away from a surface with their legs. They attained maximum velocities of approximately 10 mph. Using various launch speeds and directions, theoretical trajectories have been projected for both coplanar and noncoplanar launches. These trajectories indicate that any launch having a velocity component parallel to the direction of orbital motion will result in a trajectory such that the worker will never return to his vehicle. Author

N63-10244 National Aeronautics and Space Administration. Space Task Group, Langley Station, Va.
PROJECT MERCURY
Robert R. Gilruth. *In* Virginia Polytechnic Inst., Blacksburg. Reentry Dynamics, Part II. Proc. of the Conf. on Physics of the Solar System and Reentry Dynamics, July 31 to Aug. 11, 1961 p 351-362 (See N63-10230 01-01) VPI: $2.00

This paper discusses the history and management of Project Mercury briefly. Emphasis is placed on the problems of hardware research and development, including the following: basic concept and methods; general problems; spacecraft description and modifications; and acceleration and impact attenuation. J.R.C.

N63-10320 Joint Publications Research Service, Washington, D. C.
SOVIET DEVELOPMENT OF SPACE TRAVEL
G. Petrovich Nov. 14, 1962 10 p Transl. from Aviats. i Kosmonavt (Moscow), no 6, June 1962 p. 8–12
(JPRS-16187) OTS: $1.10

This report covers Soviet development of space travel which includes the following: the flights of the world's first artificial Earth and solar satellites; the flight to the Moon around the Moon and the photographing of its far side; the launching of heavy artificial Earth satellites of ever increasing weight; the sending into the Earth-Venus orbit of a heavy automatic interplanetary station; and the flights of Vostok I and II with cosmonauts Yu. A. Gagarin and G. S. Titov. J.R.C.

N63-10328 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LATERAL RANGE CONTROL BY BANKING DURING INITIAL PHASES OF SUPERCIRCULAR REENTRIES
Donald L. Baradell (M.S. Thesis—V.P.I.) Washington, NASA, Nov. 1962 28 p 4 refs
(NASA TN D-1511) OTS: $0.75

The feasibility of increasing the lateral range capability of reentry vehicles having low-lift-drag ratios, by allowing the vehicle to reenter in a banked attitude, is investigated. The effects of such banked reentries on allowable reentry corridor width and on lateral range capability are discussed. Numerical results are used throughout the investigation to furnish accurate evaluations of the effects being studied and to check the validity of some approximate relations presented. The heading-angle change developed during the initial pullup by a vehicle reentering in a banked attitude is shown to produce significant increases in the lateral range achieved during reentry. Emphasis is placed on reentry at escape velocity, but the results also apply in character to reentry at other supercircular velocities. Author

N63-10371 Northrop Space Labs., Hawthorne, Calif.
PRELIMINARY LOCOMOTION ANALYSIS OF LUNAR SURFACE VEHICLES
W. B. Sponsler *In* Air Force Systems Command. Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif. Transactions of the 7th Symp. on Ballistic Missile and Space Technol., U. S. Air Force Academy, Colo., Aug. 13–16, 1962 Vol. I p 23–52 14 refs (See N63-10370 01-01)

This paper summarizes a preliminary study of vehicular mobility on the lunar surface. Basic modes of controlled locomotion are discussed, and the most promising (rigid and flexible wheels and tracks) are analyzed. The effects of surface characteristics, vehicle weight and tread configuration are related to traction, rolling resistance, range, obstacle capability and acceleration. Typical examples are compared, varying the lunar surface parameters to develop a relative evaluation and to present a method for further analysis. The necessity for slow speeds and the effects of lunar environment upon traction, ride, stability, braking and other factors are also discussed. Author

N63-10440 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio
GAGARIN'S FLIGHT
N. Denisov and S. Borzenko Sept. 17, 1962 54 p Transl. from Pravda (Moscow), Apr. 23, 1961
(FTD-TT-62-844/1+2)

This paper contains a description of the first flight of man into outer space and a brief story of the astronaut's life. R.C.M.

N63-10536 National Aeronautics and Space Administration. Washington, D. C.
A RELIABILITY MODEL AND ANALYSIS FOR PROJECT MERCURY—3-ORBIT MANNED AND UNMANNED MISSION
William Wolman and Fred Okano Dec. 1962 29 p 2 refs
(NASA TN D-1558) OTS: $0.75

Based on test data of parts, components, and subsystems, the probability of successfully completing the mission and the probability of flight safety were desired for the Project Mercury 3-orbit mission. The purpose is to give the development of a mathematical model, data requirements, and other assumptions used in the Mercury reliability evaluation. Although the model was developed for the evaluation of the Mercury mission, the approach is general and can be modified for other space system applications. Author

N63-10553 National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Texas
MANNED SPACE FLIGHT
Brainerd Holmes Repr. from AIBS Bull., v. 12, no. 5, Oct. 1962 p 56–59

This paper discusses the manned space flight programs as follows: Project Mercury; one-day missions; Gemini; Project Apollo; and the lunar landing. R.C.M.

33 STRESSES AND LOADS

Includes: fatigue; vibration; flutter; and structural tests.

For related information see: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings and Control Surfaces; and 34 Structural Design.

N63-10031 Ernst Heinkel Flugzeugbau G.m.b.H., Speyer (W. Germany)
DIE EXPERIMENTELLE FLUTTERUNTERSUCHUNG VON FLUGZEUGEN [THE EXPERIMENTAL FLUTTER STUDY OF AIRPLANES]
Jos. Schoen [1962] 27 p 8 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9–12, 1962
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 35) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

Methods of measurement and measuring devices for research on flutter models in wind tunnels are described and results are presented. Advanced methods and installations are described for carrying out research on mounted oscillating models since this represents the most important phase of flutter research analysis. Photographic illustrations are presented. The procedure of harmonic simulation offered the most exact measurement method. This simulation is promoted by a seismic suspended electrodynamic stimulator. In order to provide constant control over the state of oscillation, at least one measurement value must be telemetered to a ground station and immediately interpreted. In such a manner, the entire frequency program would be telemetrically provided by a ground station, relieving the pilot of this responsibility.
Trans. by I.v.L.

N63-10066 National Aero- and Astronautical Research Inst., Amsterdam (Netherlands)

DESCRIPTION OF THE NLR CODE ACTUATED RANDOM LOAD APPARATUS (CARLA) Provisional Issue

D. Bosman Oct. 9, 1962 15 p 3 refs Presented at the [Scientific Soc. for Aviation] Annual Meeting, Brunswick, W. Germany [Oct. 9–11, 1962]

(MP-214; Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 74) Available from WGL, Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany)

A description is given of a system for fatigue tests on large structures, and gives an analysis of the performance. The system employs a hydraulic testing machine with an electronic servo apparatus. Author

N63-10085 Columbia U., New York, N. Y.

EFFECTS OF COUPLE-STRESSES IN LINEAR ELASTICITY

R. D. Mindlin and H. F. Tiersten July 1962 69 p 19 refs

(Contract Nonr-266(09))

(Tech. Rept. 48)

In a theory of deformation of continua, originated by Voigt and amplified by E. and F. Cosserat, the couple per unit area, acting across a surface within a material volume or on its boundary, was taken into account in addition to the usual force per unit area. Some typical effects of such "couple-stresses" are exhibited, in the present paper, by means of solutions of problems of wave-propagation, vibration, stress-concentration and nuclei of strain—all within the framework of a linearized form of the couple-stress theory for perfectly elastic, centrosymmetric-isotropic materials. Author

N63-10086 Columbia U., New York, N.Y.

INFLUENCE OF COUPLE-STRESSES ON STRESS CONCENTRATIONS

R. D. Mindlin Sept. 1962 30 p 5 refs

(Contract Nonr-266(09))

(Tech. Rept. 49)

An analysis is presented for determining the influence of couple-stresses on stress concentrations. Two-dimensional equations of couple-stress theory for an isotropic, elastic medium are derived. The components of stress and couple-stress are then expressed in terms of the Airy stress function and another stress function which accounts for the couple stresses. After a transformation to polar coordinates, the stress distributions are found for a circular hole in various two-dimensional fields of stress. With couple-stresses taken into account, the stress concentration factor, instead of having the usual value 3, depends both on Poisson's ratio and the ratio of the radius of the hole, a, to the material constant l. As a/l becomes large, the stress concentration factor approaches 3. As a/l diminishes, so does the stress-concentration factor. For example, if a/l is 3, the reduction is about 12 to 20 percent, depending on Poisson's ratio. For equal tensions or equal compressions, couple-stresses have no effect; but, for pure shear, the percent reduction of the usual stress concentration factor of 4 is even larger than for simple tension: 18 to 30 percent in the case of a/l = 3. B.J.C.

N63-10113 Syracuse U. Research Inst., N.Y.

DEFORMATIONS AND STABILITY OF SPHERICAL SHELLS UNDER ACTION OF CONCENTRATED LOADS AND UNIFORM PRESSURE Technical Report [No. 4] Sept. 11, 1961-June 1, 1962

R. M. Evan-Iwanowski and T. C. Loo June 1962 85 p 43 refs

(Grant DA-31-124-61-G24)

(SURI-TR-834(II) No. 4; Rept. 834(11)-626T4; AROD-2465-5)

Deformations and collapse of a series of spherical shells with a wide range of geometry parameter λ, ($\lambda^4 = \alpha^4 [12 (1-\nu)^2/(Rt)^2]$) and edge supports subjected to the action of concentrated loads, uniform loads, and combination of uniform and concentrated loads have been investigated.

The prebuckling and postbuckling histories of the deflections, stress distributions, and critical curves (showing the relationship between critical loadings and geometry parameter λ) have been determined. Author

N63-10179 National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

BUCKLING OF RING-STIFFENED CYLINDERS UNDER A PURE BENDING MOMENT AND A NONUNIFORM TEMPERATURE DISTRIBUTION

Melvin S. Anderson and Michael F. Card Washington, NASA, Nov. 1962 33 p 5 refs

(NASA TN D-1513) OTS: $1.00

Thirteen stainless-steel ring-stiffened cylinders were subjected to a pure bending load and heated rapidly until buckling occurred. For most of the cylinders the heating was not uniform around the circumference so that appreciable axial thermal stresses were present. Elementary thermal stress theory was found to be inadequate for the prediction of these thermal stresses, but a method was developed that would give satisfactory thermal stress results. By properly accounting for the thermal stress, the buckling load could be correlated with a theory for the buckling of an axially compressed ring-stiffened cylinder that is uniformly heated. Author

N63-10188 Massachusetts Inst. of Tech. Aeroelastic and Structures Research Lab., Cambridge

MECHANICAL BEHAVIOR OF THE TWO-PHASE COMPOSITE, TUNGSTEN-NICKEL-IRON

Richard H. Krock and Lawrence A. Shepard Aug. 1962 41 p 22 refs

(Contract AF 49(638)-775)

(ASRL-TR-94-4)

A series of ductile, two-phase W-Ni-Fe composites, sintered in the presence of a liquid phase, were tested in tension. Identical room temperature stress-strain curves were obtained for specimens containing from 80 to 92 wt. percent W (58 to 75 vol. percent W particles). The composites exhibited a maximum elongation of 29 percent at room temperature, and 10.7 percent at 77°K. The W particles in the composite elongated by the same amount at these temperatures. Single-phase alloy specimens matching the composition of the composite matrix showed about one half the flow stress of the composites. The test results demonstrated that the mechanical properties of W-Ni-Fe composites are determined by the W particles alone and are independent of matrix volume fraction or mean free path over the composition range studied. Author

N63-10205 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EXPERIMENTAL INVESTIGATION AT MACH NUMBER 3.0 OF EFFECTS OF THERMAL STRESS AND BUCKLING ON FLUTTER CHARACTERISTICS OF FLAT SINGLE-BAY PANELS OF LENGTH-WIDTH RATIO 0.96

Sidney C. Dixon. Washington, NASA, Nov. 1962 34 p 19 refs

(NASA TN D-1485) OTS: $1.00

Tests were conducted at dynamic pressures from 1,500 pounds per square foot to 5,000 pounds per square foot, and at stagnation temperatures from 300°F to 660°F. The panel supporting structure allowed partial thermal expansion of the skins. Panel skin material and skin thickness were varied. An overall flutter boundary is presented in terms of a modified temperature parameter, which approximately accounts for the effects of differential pressure and variations in panel skin material and skin thickness, and indicates the effects of thermal stress and buckling on the flutter characteristics of the panel. The experimental results are compared with theory for the condition of zero stress and for the onset of buckling. Author

N63-10278 Aerospace Information Div., Library of Congress, Washington, D.C.
SOVIET DESIGNING OF AIRCRAFT GAS TURBINES
Nov. 2, 1962 2 p Review of: Aleksey Fedorovich Gurov Sovmestnyye kolebaniya v gazoturbinnykh dvigatelyakh (Simultaneous vibrations in gas-turbine engines) Moscow, Oborongiz, 1962 142 p
(AID-62-181) OTS: $1.10 ph, $0.80 mf

Excerpts are presented from Soviet sources to throw some light on the vibration problems that concern Soviet designers of aircraft gas-turbine engines. These indicate that one source of vibration is due to the tendency to reduce the weight of engine structures which results in lower rigidity. It is also noted that a precise analysis of the gas-turbine vibration process is not yet possible and that little work has been done on simultaneous vibrations. R.C.M.

N63-10352 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio
RESULTS OF STRESS-RUPTURE TESTING OF CAST NICKEL ALLOYS AT 800°
R. P. Zoletayeva Sept. 24, 1962 8 p Transl. from Tsentr. Nauchn.-Issled. Inst. Tekhnol. i Mashinostr., v. 101, 1961 p 205-209
(FTD-TT-62-720/1+2+4)

Stress-rupture tests have been made on nickel alloys to determine their resistance to long period exposures at high temperatures. Specimens were prepared by both precision casting and sand mold casting alloys A and B. Tests were made at intervals up to 4,000 hours exposure time at 800° and extrapolated up to 11,000 hours. Alloy B showed an advantage in stress-rupture strength over alloy A at a service life up to 3,000 to 5,000 hours. The stress-rupture strength of alloy B was 37 kg/mm² after 1,000 hours and 16 kg/mm² after 10,000 hours. It is concluded that detailed investigations of the required properties of these alloys should be made relative to the operating conditions of transport gas turbines with an operating time up to 10,000 hours. R.C.M.

N63-10417 Polytechnic Inst. of Brooklyn, N. Y.
APPLICATION OF VARIATIONAL EQUATION OF MOTION TO THE NONLINEAR VIBRATION ANALYSIS OF HOMOGENEOUS AND LAYERED PLATES AND SHELLS Technical Note No. 14
Yi-Yuan Yu Feb. 1962 30 p 16 refs
(Contract AF 49(638)-453)
(AFOSR-TN-2256)

An integrated procedure is presented for applying the variational equation of motion to the approximate analysis of nonlinear vibrations of homogeneous and layered plates and shells involving large deflections. The procedure consists of a sequence of variational approximations. The first of these involves an approximation in the thickness direction and yields a system of equations of motion and boundary conditions for the plate or shell. Subsequent variational approximations with respect to the remaining space coordinates and time, wherever needed, lead to a solution to the nonlinear vibration problem. The procedure is illustrated by a study of the nonlinear free vibrations of homogeneous and sandwich cylindrical shells, and it appears to be applicable to still many other homogeneous and composite elastic systems. Author

N63-10418 Polytechnic Inst. of Brooklyn, N. Y.
NONLINEAR FLEXURAL VIBRATIONS OF SANDWICH PLATES Technical Note No. 12
Yi-Yuan Yu Feb. 1962 22 p 22 refs
(Contract AF 49(638)-453)
(AFOSR-1310)

A set of nonlinear equations describing the vibrations of sandwich plates is derived. These equations are then applied to a plate vibrating in plane strain and to a rectangular plate, with the boundary edges assumed to be hinged in both cases. It is shown that the nonlinear frequencies increase with the amplitude of vibration. It is shown also that transverse shear deformations play an important role; however, the effect produced by these deformations decreases with increasing amplitudes of vibration. Author

N63-10470 Aerojet-General Corp., Azusa, Calif.
RELATIONSHIP BETWEEN FLUTTER PARAMETERS AND GENERALIZED AERODYNAMIC FORCES FOR WINGS OF LOW ASPECT RATIO [Fifth] Technical Documentary Report [June 1960–July 1961]
Bernard Mazelsky and Harry B. Amey, Jr. Wright-Patterson AFB, Ohio, Flight Dynamics Lab., Sept. 1962 45 p 2 refs
(Contract AF 33(616)-7420)
(Rept. 2249; ASD-TDR-62-462)

A set of closed-form approximations is derived which relates the flutter conditions of a wing to its generalized aerodynamic forces. A simplified two-mode analysis is used to obtain a first-order approximation. More general analyses are performed by treating additional effects as perturbations. The derivations are applicable to a wide class of low-aspect-ratio wings and apply to subsonic, transonic, supersonic, and hypersonic flow. Author

N63-10471 Aerojet-General Corp., Azusa, Calif.
APPLICATION OF THE NASA KERNEL-FUNCTION PROCEDURES TO GENERALLY DEFORMING WINGS [Final Report, June 1960-Apr. 1962]
Bernard Mazelsky and Harry B. Amey, Jr. Wright-Patterson AFB, Ohio, Flight Dynamics Lab., Oct. 1962 45 p 3 refs
(Contract AF 33(616)-7420)
(Rept. 2214; ASD-TDR-62-409)

A method is described for obtaining generalized aerodynamic forces by utilizing the NASA Kernel-Function Procedures. An evaluation of the generalized aerodynamic forces and the consequent flutter conditions is made for the particular case of a uniform, cantilevered, 70° delta wing. The supersonic Kernel-Function Procedure was found to be inadequate for treating the elastic modes on this low-aspect-ratio wing; the subsonic procedure, however, appears to work satisfactorily. The theoretical flutter predictions are compared with the experimental results of NASA Report TM X-53. The Kernel-Function predictions for quasi-steady flow ($k \to 0$) appear to be superior to those for the complete unsteady case $\left(k = \frac{\omega_{fCr}}{2V_f}\right)$. Based on this limited comparison, it appears that for this low-aspect-ratio wing the large transient effects predicted by linearized theory in the transonic regime may not actually exist. Author

N63-10473 Boeing Co., Vertol Div., Morton, Pa.
A STUDY OF TANDEN HELICOPTER FUSELAGE VIBRATION [Final Report, 1957-Jan. 1962]
Robert G. Ricks Wright-Patterson AFB, Ohio, Flight Dynamics Lab., Sept. 1962 286 p 12 refs
(Contract AF 33(616)-5240)
(R-275; ASD-TDR-62-284)

A comprehensive research program covering many facets of tandem rotor helicopter fuselage vibration was conducted. Analytical portions consisted of the development of methods for the prediction of fuselage natural and forced modes; test portions of the program determined fuselage stiffness properties, rotor shaft vibratory loads and in-flight natural frequencies, modes and vibration levels. The results have proven to be of considerable value in the design of the present generation of helicopters. Author

N63-10525 Southwest Research Inst., San Antonio, Tex.
STUDIES IN BIAXIAL CREEP [Final Technical Report, Feb. 1, 1961-May 31, 1962]
E. Z. Stowell and R. K. Gregory Wright-Patterson AFB, Aeronautical Research Labs., Sept. 1962 22 p 9 refs
(Contract AF 33(611)-7981)
(ARL 62-434)

Tensile and torsional stresses were applied simultaneously to thin-walled tubes of aluminum alloy at an elevated temperature (400° F). Different identical tubes were subjected to different combinations of tension and torsion, the stresses being so chosen that the combined stress intensity remained substantially constant. Simultaneous measurements were made of the resulting tensile and torsional strains. Each test was continued until the creep had definitely entered the final stage. The measured constant creep rates in the steady state were found to agree closely with those which would be expected from classical plasticity theory using the Mises concepts of stress intensity and strain rate intensity. Author

N63-10532 National Aeronautics and Space Administration, Washington, D. C.
STATISTICAL METHODS IN THE NONLINEAR THEORY OF ELASTIC SHELLS
V. V. Bolotin Dec. 1962 17 p 8 refs Translation of "Statisticheskiye metody v nelineynoy teorii uprugkih obolochek" from Izv. Akad. Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, 1958, no. 3, p. 33–46. Presented at a seminar in the Inst. of Mechanics of the Academy of Sciences USSR, Oct. 3, 1957
(NASA-TT-F-85) OTS: $0.50

A statistical method is presented for calculation of the mathematical expectation and dispersion of buckling loads of an arbitrary shell characterized by a finite number of parameters defining not only the loads but also initial deformations, defects in manufacture, and so forth. The method should be useful in design calculations and in interpreting experimental data for the buckling of elastic shells. Calculated values for a shallow cylindrical panel are in good agreement with the mean value of experimentally determined critical forces. Author

34 STRUCTURAL DESIGN

Includes: structural elements; and weight analysis.

For related information see: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings and Control Surfaces; and 33 Stresses and Loads.

N63-10030 Deutsche Versuchsanstalt für Luft- und Raumfahrt. Inst. für Festigkeit, Mülheim an der Ruhr (W. Germany)
ORTHOTROPE KEGELSCHALE: ÜBER DAS ELASTISCHE STABILITÄTSVERHALTEN DUNNWANDIGER ORTHOTROPER KEGELSCHALEN UNTER AXIALLAST UND INNENDRUCK [ORTHOTROPIC CONICAL SHELLS: ON THE ELASTIC STABILITY BEHAVIOR OF THIN-WALLED ORTHOTROPIC CONICAL SHELLS UNDER AXIAL LOAD AND INSIDE PRESSURE]
Klaus Schiffner 1962 17 p 8 refs In German Presented at the Scientific Soc. for Aviation Annual Meeting, Brunswick, W. Germany, Oct. 9–12, 1962
(Supported by the Deutsche Forschungsgemeinschaft)
(Wissenschaftlichen Gesellschaft für Luftfahrt Paper No. 34) Available from Friedrich Vieweg & Son, Burgplatz 1, Brunswick, W. Germany

The study of the stability behavior of orthotropic conical shells is conducted after a linearized theory. Although a general solution of the differential equations for the buckling condition in a conclusive and final form is not possible, employment of the energy method provides an approximate solution. The results of the theoretical study have been compared with values obtained in actual tests. Trans. by A. S.

N63-10072 Douglas Aircraft Co., Inc., Long Beach, Calif.
DESIGN CONCEPTS FOR MINIMUM WEIGHT, HIGH PERFORMANCE SUPERSONIC AIRCRAFT STRUCTURES Second Quarterly Technical Report [July 1-Oct. 1, 1962]
G. T. Rowe, J. S. Dunning et al Oct. 1, 1962 159 p 13 refs
Contract AF 33(657)-8541)
(DAC-31041)

Research investigations on wing and fuselage concepts for Mach 3 supersonic transport structures are reported. Structural design criteria are modified and extended. Stainless steel, titanium, and brazing materials are ordered, and limited material tests are performed. Specimens for wing and fuselage structural and thermal tests are designed, and manufacturing investigations are initiated. Initial redundant force analyses of wing structure are described. Thermal analyses, including modifications to heat transfer computer programs, are continued. Variable sweep wing structures are developed and investigations, including redundant force analyses, are initiated. Plans for structural and thermal tests are presented. Author

N63-10091 Republic Aviation Corp., Farmingdale, N. Y.
THE MINIMUM WEIGHT DESIGN OF STRUCTURES OPERATING IN AN AEROSPACE ENVIRONMENT [Final Report, Jan. 15 to Nov. 15, 1962]
H. Switzky Wright-Patterson AFB, Ohio, Flight Dynamics Lab., Oct. 1962 146 p 22 refs
(Contract AF 33(657)-7872)
(RAC-442-1(ARD-823-2); ASD-TDR-62-763)

A nondimensional design technique is developed to obtain the minimum weight of structural components (columns, plates, and beams) subjected to an aerospace environment. Design curves are developed and presented for various structural configurations in terms of the applied loads and geometric and material parameters which can be readily evaluated. The design technique can be employed to obtain, in a relatively simple and rapid manner, preliminary estimates of the structural design weight as well as a good approximation to the final design. The design procedure for minimum weight is illustrated for a truss-like spar and a wing section which are typical of aerospace structures. Author

N63-10161 Technical Operations, Inc., Burlington, Mass.
HYPERVELOCITY PARTICLE EFFECTS ON MATERIAL Second Quarterly Progress Report
Victor E. Scherrer and Robert R. McMath Dec. 31, 1961 22 p
(Contract AF 33(616)-8423)
(TO-B-62-3; AD-272-669) ASTIA: $1.60

This report on hypervelocity particle effects on materials presents data on the energy storage system, the hypervelocity gun, the streak camera, the backlighting source, and spectral and miscellaneous equipment. It also includes some of the preliminary results of the ballistic research program as well as the results obtained from various experiments carried out to improve the performance of the hypervelocity gun. In addition, some preliminary results of target impacts in the range of projectile velocities between 20,000 to 62,500 ft/sec are included. The velocities of 20,000 to 62,800 ft/sec have been reached in projecting 11-mg particles, and the range of projectile densities have been extended from 0.9 to 2.2 by successfully accelerating polyethylene, Mylar, and Teflon. J.R.C.

N63-10238 National Aeronautics and Space Administration, Washington, D. C.
THERMAL PROTECTION SYSTEMS AND STRUCTURES FOR REENTRY VEHICLES
Roger A. Anderson *In* Virginia Polytechnic Inst., Blacksburg. Reentry Dynamics, Part II. Proc. of the Conf. on Physics of the Solar System and Reentry Dynamics, July 31 to Aug. 11, 1961 p 207–230 9 refs (See N63-10230 01-01) VPI: $2.00

Fundamental capabilities and weight studies are presented for thermal protection systems and structural approaches used in the design of reentry vehicles. The information covered includes the following: reentry heating environment; thermal protection concepts; uninsulated radiation-cooled structure; insulated radiation-cooled structure; design problems with insulated structures; radiative structure with internal cooling; and system evaluation. J.R.C.

N63-10388 Avco Corp. Research and Advanced Development Div., Wilmington, Mass.

RELIABILITY AS A THERMOSTRUCTURAL DESIGN CRITERION

F. W. Diederich, W. C. Brading, A. J. Hanawalt, and R. Sirull *In* Air Force Systems Command. Office of the Deputy Commander for Aerospace Systems, Los Angeles, Calif. Transactions of the 7th Symp. on Ballistic Missile and Space Technol., U. S. Air Force Academy, Colo., Aug. 13–16, 1962 Vol. I p. 493–536 7 refs (See N63-10370 01-01)

(Contract AF 04(647)-16; and AF 04(647)-36)

An approach is outlined for using reliability as a design criterion for thermostructural and similar systems in place of sets of safety factors for combinations of various environments; the primary objective of which is to avoid the sometimes large, but almost invariable unknown, degree of conservatism introduced by the combination of safety factors. Several methods are indicated for implementing this approach with emphasis on a small-perturbation method and a Monte-Carlo method. The estimation of confidence limits for the calculated reliability in terms of an implied sample size determined by the uncertainty of the available information is discussed. The use of this approach in failure-mode analyses, reliability apportionment, and similar reliability calculations is indicated. Author

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